Public Health Reports

Vol. 56 • SEPTEMBER 5, 1941 • *No. 36*

THE DIVERSE ETIOLOGY OF EPIDEMIC INFLUENZA [1]

By E. H. Lennette, E. R. Rickard, G. K. Hirst, and F. L. Horsfall, Jr.

Numerous studies on the cause of epidemic influenza have shown that the disease results from infection by a virus. Following the discovery by Smith, Andrewes, and Laidlaw (*1*) of what is now termed influenza A virus (*2*), numerous workers in laboratories in various parts of the world confirmed their findings and agreed with the view that this agent was responsible for many cases of epidemic influenza. Some modification of this broad concept became necessary when Francis (*3*) found that an epidemic of the disease which occurred in California could not be shown to have been caused by this virus. Subsequently Stuart-Harris, Smith, and Andrewes (*4*), as well as Rickard, Lennette, and Horsfall (*5*), demonstrated that only a certain proportion of cases studied in localized epidemics were due to this agent. These reports made it evident that epidemic influenza was not a single etiological entity and indicated that at least two distinct causal agents were capable of producing the disease.

Recently Magill (*6*) and Francis (*7*), independently and simultaneously, described influenza viruses which were different from influenza A virus and demonstrated the causal relationships of these agents to the disease. One of these new agents has been termed influenza B virus (*7*). The available published data (*6, 7, 8, 9*) seem to indicate that influenza A (*2*) and influenza B (*7*) are etiologically distinct although clinically similar diseases.

During the past year a number of epidemics of influenza occurred in various parts of this country and in some of the Caribbean Islands. The availability of two distinct etiological agents has made possible a study of the cause of the disease in a number of representative cases from certain of these epidemics. The results have been unexpected. It is the purpose of this paper to present evidence indicat-

[1] From the Laboratories of the International Health Division of The Rockefeller Foundation, New York.

ing that cases of influenza in one epidemic, even in a single institution, may be due to infection by one or more of at least three distinct agents.

MATERIAL AND METHODS

Viruses.—The PR8 strain (*10*) of influenza A virus and the Lee strain (*7*) of influenza B virus were used throughout this study. Both viruses had been established in mice. The former had been through more than 330 serial passages, while more than 50 passages of the latter had been made in this species. Standard suspensions of mouse lungs infected with one or the other virus were prepared as described previously (*11*) and were stored in a low temperature cabinet (*12*) at −76° C. Each time either virus was used in a neutralization test a titration was made to determine the infectiousness of the suspension for mice.

Serum.—Acute-phase sera were obtained from the majority of individuals who provided throat washings, as well as from numerous other cases in each epidemic. These sera were taken in the early stages of the disease, usually between the first and fourth day after the clinical onset. Convalescent sera were obtained from the same individuals between 2 and 3 weeks later. The sera were stored at 4° C.

Neutralization test.—Neutralization tests with human sera were carried out exactly as previously described (*13*). Serial fourfold dilutions of serum were mixed with constant amounts of either the PR8 strain of influenza A virus or the Lee strain of influenza B virus. Usually 300 fifty percent mortality doses of influenza A virus and either 30 or 300 of influenza B virus were used. In almost every instance acute-phase and convalescent sera from one patient were run in the same test. Serum dilution and virus titration end points were determined by the 50 percent end point method of Reed and Muench (*14*), and from these figures the neutralizing capacity of each serum was calculated as described previously (*15*). It has been found that the linear relationship between the quantity of serum used and the quantity of virus neutralized was also operative with influenza B virus. A significant increase in neutralizing antibodies against either virus was considered to have occurred when the titer of the convalescent serum was found to be fourfold or more higher than that of the acute-phase serum. A fourfold increase in titer corresponds to an increase in neutralizing capacity of log 0.86 and exceeds the experimental error of the method by at least 3 times (*15*).

Complement fixation tests.—Complement fixation tests were carried out in a manner identical to that described previously (*5*). Mouse lung antigens were prepared with either the PR8 strain of influenza A virus or the Lee strain of influenza B virus. These antigens were

standardized against pools of convalescent human sera of known complement-fixing titer for either antigen. Complement-fixing antibody titers were determined for both the acute-phase and the convalescent sera in the same test. The serum titer was taken as equal to that dilution which gave 3+ or 4+ fixation with the particular antigen used. A significant increase in complement-fixing titer was considered to have occurred when the convalescent serum titer was one or more dilutions higher than the titer of the acute-phase serum.

Throughout this study the neutralization test has been considered more specific and more reliable than the complement fixation test. Consequently, whenever discrepancies occurred in the results obtained by these two tests on sera from one case, the results of the neutralization test were taken to be correct.

Throat washings.—Throat washings were obtained by the method previously described (*13*) from representative and clinically typical cases of influenza during the first few days of the disease. The throat washings were rapidly frozen in solid carbon dioxide and stored in a low temperature cabinet (*12*) at −76° C. The presence of either influenza A virus or influenza B virus in a throat washing was determined by the inoculation of either ferrets or Syrian hamsters. The former animals were given 2 cc. and the latter 0.5 cc. of untreated throat washing intranasally under ether anesthesia. The clinical course of inoculated ferrets was followed carefully; temperatures were taken twice daily, and the animals were kept in special isolation cubicles (*16*) during the observation period. From 10 to 14 days after inoculation the ferrets and hamsters were bled from the heart. The sera so obtained, as well as control normal sera from the same animals, were run in neutralization tests against approximately 30 fifty percent mortality doses of influenza A virus or influenza B virus. These small quantities of the two viruses were used in order that very small amounts of neutralizing antibody could be detected. It has been our experience that clinical evidences of infection by influenza A virus in ferrets are unreliable. The demonstration of a specific antibody response against either influenza A or B virus in inoculated animals is, however, certain evidence that infection by one or the other of these agents has occurred.

EXPERIMENTAL

During the winter of 1940 localized epidemics of clinically mild influenza occurred in the vicinity of New York City. At approximately the same time a widespread outbreak of the disease, also clinically mild, occurred in North Carolina. Neutralization and complement fixation tests with influenza A virus were carried out with acute-phase and convalescent sera obtained from a number of representative cases in each of these outbreaks. In only four cases was a

significant increase in antibodies against influenza A virus demonstrated in the convalescent sera. Furthermore, ferrets inoculated with throat washings taken from cases in the North Carolina epidemic failed to produce any antibodies against influenza A virus. These results indicated that less than 10 percent of the cases selected for study in these epidemics had been infected by influenza A virus. Subsequently when influenza B virus became available, the pairs of human sera and the sera obtained from ferrets after the inoculation of throat washings were restudied in tests against this agent.

The results of these tests with throat washings and sera from cases in the New York and North Carolina epidemics are shown in table 1. In the former epidemic 24 cases were studied. Two showed during convalescence a significant increase in neutralizing antibodies against influenza A virus only. Thirteen had a significant increase in antibodies against influenza B virus. One case was found to have produced additional antibodies against both viruses. In this case the neutralization tests with both agents were repeated, and the increase in antibodies against both was confirmed. Eight cases showed no significant alteration in the concentration of antibodies against either virus during convalescence. Throat washings from this epidemic were not tested in ferrets.

TABLE 1.—*Results of studies of sera and throat washings from cases of clinical influenza in epidemics during February 1940*

Place	Cases tested for increases in antibodies									Throat washings tested			
	Number tested	Significant increase demonstrated against—						Significant increase not demonstrable		Number tested	Viruses demonstrated		Virus not demonstrable
		A virus		B virus		Both A and B							
		Number	Percent	Number	Percent	Number	Percent	Number	Percent		A	B	
New York	24	2	8	13	54	1	4	8	34	0	-----	-----	-----
North Carolina	17	0	0	8	47	1	6	8	47	9	0	5	4
Total	41	2	5	21	51	2	5	16	39	9	0	5	4

In the North Carolina epidemic 17 cases were studied. None of these cases showed a significant increase in neutralizing antibodies against influenza A virus alone. Eight had a significant increase in antibodies against influenza B virus. One case produced additional antibodies against both viruses. Eight cases had the same concentrations of antibodies against both agents in the acute phase and during convalescence. Throat washings from 9 cases were inoculated in ferrets. None of the ferrets when bled 2 weeks later possessed neutralizing antibodies against influenza A virus. However, 5 had antibodies against influenza B virus. Three of these 5 washings were

obtained from patients who showed during convalescence an increase in antibodies against influenza B virus. One was obtained from the patient who was found to have shown an increase in antibodies against both influenza A and B viruses. The other was obtained from a patient on whom no convalescent serum was available.

In the light of previous studies on the etiology of epidemics of influenza, these results were quite unexpected since they seemed to indicate clearly that, whereas some cases in the New York epidemic had been infected with influenza A virus, others which occurred simultaneously had been infected by influenza B virus. Furthermore, the fact that no evidence was obtained of infection by either of these two viruses in 39 percent of the representative cases selected for study in the two epidemics suggested the possibility that some other agent, or agents, unrelated antigenically either to influenza A virus or to influenza B virus, had been responsible for the infections in these instances.

During the summer of 1940 widespread outbreaks of influenza occurred in some of the Caribbean Islands. The epidemics in Puerto Rico and Cuba seemed to have commenced during the latter part of June and reached their peaks during July and August, respectively. A few weeks after these two epidemics had begun numerous individuals in both islands who had not yet contracted influenza were given a single subcutaneous injection of a complex vaccine against influenza A (*17*). Throat washings, as well as acute-phase and convalescent sera, were obtained from a number of representative cases in these two epidemics and were tested by the methods described above. In some instances these specimens were obtained from patients who had been vaccinated a few days before the onset of influenza. These latter individuals have been excluded from the present analysis of the incidence of influenza A because of the impossibility of determining whether observed increases in neutralizing antibodies against influenza A virus resulted from the administration of the vaccine or natural infection by the virus.

The results of tests with throat washings and serum from cases in the epidemics in Puerto Rico and Cuba are shown in table 2. In the former epidemic 22 cases were studied. In 12 cases a significant increase in neutralizing antibodies against influenza A virus was demonstrated during convalescence. In 10 cases no increase in antibodies against this virus was found. Sera from 21 of these cases were also studied in neutralization tests against influenza B virus, and in no instance was a significant increase in antibodies demonstrated. Consequently, in 9 cases additional antibodies were not produced against either virus. Ferrets were inoculated with throat washings from 16 cases, hamsters were inoculated with throat washings from 4 cases, and both a ferret and hamster were inoculated with

a throat washing from 1 case. In no instance did the ferret sera obtained 2 weeks after these inoculations contain neutralizing antibodies against influenza A virus. One hamster was found to have produced antibodies against this virus following inoculation with a throat washing from a patient who showed an increase in antibodies against influenza A virus. However, this same throat washing, when given to a ferret, did not stimulate the production of antibodies against this agent.

TABLE 2.—*Results of studies of sera and throat washings from cases of clinical influenza in epidemics during July and August 1940*

Place	Cases tested for increases in antibodies									Throat washings tested			
	Number tested	Significant increase demonstrated against—						Significant increase not demonstrable		Number tested	Viruses demonstrated		Virus not demonstrable
		A virus		B virus		Both A and B							
		Number	Percent	Number	Percent	Number	Percent	Number	Percent		A	B	
Puerto Rico	22	12	60	0	0	0	0	9	43	21	1	0	20
Cuba:													
Institution 1	53	22	41	0	0	1	2	30	57	10	1	0	9
Institution 2	31	0	0	25	81	0	0	6	19	17	0	9	8
Total	106	34	33	25	24	1	1	45	42	48	2	9	37

In the Cuban epidemic 84 cases were studied. These cases occurred simultaneously in two institutions in the same city. The results in these two outbreaks are shown separately in table 2. In Institution 1, 53 cases were investigated and in 22 a significant increase in antibodies against influenza A virus was demonstrated during convalescence. One case was found to have significantly increased concentrations of antibodies against both influenza A and B virus. The remaining 30 cases failed to manifest an increase in antibodies against either virus during convalescence. Throat washings from 10 cases in Institution 1 were inoculated in ferrets. Seven were also given to hamsters. Four of these throat washings were obtained from cases in which an increase in antibodies against influenza A virus was demonstrated. One of these washings stimulated the formation of neutralizing antibodies in the inoculated ferret. The other 3 washings, as well as the 6 obtained from cases which manifested no increase in antibodies against either virus, failed to cause the production of antibodies against influenza A or B virus in ferrets or hamsters.

In Institution 2, 31 cases were investigated. None was found to have an increased concentration of antibodies against influenza A virus during convalescence. In 25 cases a significant increase in antibodies against influenza B virus was demonstrated. The re-

maining 6 cases manifested no increase in antibodies against either virus during convalescence. Throat washings from 17 cases in Institution 2 were inoculated in ferrets, and 16 were also given to hamsters. Sixteen washings were obtained from cases which showed an increase in antibodies against influenza B virus during convalescence. Nine of these washings stimulated the production of neutralizing antibodies against this virus in the inoculated animals. In one instance both the ferret and the hamster possessed antibodies when bled 2 weeks after inoculation. In 7 instances the ferret had developed antibodies, but the hamster had not. In 1 instance the ferret did not possess antibodies while the hamster did. In the case of the other 8 washings none of the inoculated animals developed antibodies against influenza B virus. In no instance were antibodies against influenza A virus demonstrated following inoculation of ferrets or hamsters with the washings obtained in Institution 2.

The results obtained in the epidemics in Puerto Rico and Cuba were even more unexpected than those obtained in the outbreaks in New York and North Carolina. It seems apparent that both influenza A virus and influenza B virus were present at the same time in the Cuban epidemic and that, while a moderate proportion of cases in Institution 1 were infected by the former virus, a larger proportion of cases in Institution 2 were infected by the latter virus. Of equal significance is the fact that 40 percent or more of the cases studied in both insular epidemics manifested no demonstrable evidence of having been infected by either virus.

During December 1940 and January 1941 widespread outbreaks of influenza occurred in various parts of the United States. A number of cases which occurred among the general population in Kentucky, Tennessee, New York, and Connecticut were studied. A larger number of cases which occurred in various institutions or Army camps in Kentucky, New York, Florida, and Alabama were also investigated. Throat washings, as well as acute-phase and convalescent sera, were obtained from representative cases in each of these outbreaks and were tested by the methods described above. In Florida and Alabama, groups of individuals in various institutions had been given a single subcutaneous injection of a complex vaccine against influenza A (*17*) approximately 4 months before the epidemic occurred. Cases of influenza which occurred in these vaccinated groups were included in this study of the etiology of the disease since it was found that the usual laboratory procedures served to establish the etiological agent responsible for these cases as readily as in unvaccinated individuals.

The results of tests with throat washings and sera from cases in the epidemics occurring in Kentucky, Tennessee, New York, Connecticut, Florida, and Alabama are shown in table 3. The results

obtained in the various institutional outbreaks are presented separately. In each case acute-phase and convalescent sera were tested against influenza A virus by either complement fixation or neutralization, or both. With the sera from almost all of these cases, complement fixation tests were also carried out against influenza B virus. It will be observed that wide differences in the proportion of cases in which a significant increase in antibodies against influenza A virus was demonstrated were encountered in the various outbreaks. For example, only 19 percent and 37 percent of the cases studied in Camp 1 in Kentucky and in Institution 7 in Alabama, respectively, had produced additional antibodies against this virus. On the other hand, in no fewer than 95 percent and 86 percent of the cases studied in Institutions 4 and 2, respectively, in Alabama, increased antibody levels against influenza A virus were demonstrated during convalescence. It will also be observed that in only 2 of the cases which showed no additional antibodies against influenza A virus was an increase in antibodies against influenza B virus demonstrated. In 4 cases an increase in antibodies against both viruses was found. In 2 of these latter 4 cases the fact that antibodies against one or both viruses had been produced was confirmed by neutralization tests. Finally, it will be noted that in 327 cases in which tests with acute-phase and convalescent sera were carried out against both viruses no evidence of an antibody response directed against either agent was demonstrated.

TABLE 3.—*Results of studies of sera and throat washings from cases of clinical influenza in epidemics during December 1940 and January 1941*

Place	Institution	Cases tested for increases in antibodies										Throat washings tested			
		Significant increase demonstrated against—								Significant increase not demonstrable		Number tested	Viruses demonstrated		Virus not demonstrable
		A virus			B virus			Both A and B							
		Number tested	Number positive	Percent positive	Number tested	Number positive	Percent positive	Number positive	Percent positive	Number	Percent		A	B	
Kentucky	1	37	7	19	37	0	0	0	0	30	81	10	4	0	6
	2	37	26	70	37	1	2.7	1	2.7	9	24	0	0	0	0
Tennessee	....	39	23	59	39	0	0	0	0	16	41	0	0	0	0
New York	....	68	33	49	66	0	0	1	1.5	32	48	0	0	0	0
Connecticut	....	19	16	84	19	0	0	1	5.3	2	11	0	0	0	0
Florida	1	85	64	75	72	0	0	1	1.4	19	26	9	7	0	2
	2	208	134	64	194	1	0.5	0	0	73	38	0	0	0	0
	3	70	51	73	68	0	0	0	0	17	25	0	0	0	0
Alabama	1	192	139	72	192	0	0	0	0	53	28	5	4	0	1
	2	42	36	86	42	0	0	0	0	6	14	0	0	0	0
	3	172	140	81	172	0	0	0	0	32	18	1	0	0	1
	4	101	96	95	100	0	0	0	0	4	4	1	1	0	0
	5	29	20	69	28	0	0	0	0	8	29	5	4	0	1
	6	37	23	62	36	0	0	0	0	13	33	0	0	0	0
	7	24	9	37	22	0	0	0	0	13	59	0	0	0	0
Total	....	1,160	817	70	1,124	2	0.2	4	0.4	327	29	31	20	0	11

Throat washings obtained from 31 cases in these various outbreaks were inoculated intranasally in ferrets. In 23 of these cases an increase in antibodies against influenza A virus was demonstrated during convalescence. Of the ferrets inoculated with these throat washings 20 were found to have produced antibodies against this virus when bled 2 weeks later, while none had produced antibodies against influenza B virus. Eleven of the 31 ferrets gave no antibody response to either virus.

The results obtained in the 15 separate outbreaks studied in these 6 States differed markedly from those found in the studies of earlier epidemics during 1940. In all but three of these outbreaks the evidence indicated that influenza A virus had been causally related to more than 50 percent of the cases studied. On the other hand, evidence which suggested that influenza B virus had caused infections was obtained in only 6 cases, of which 4 also showed evidence of infection by influenza A virus. The large number of cases in which no indication of infection by either virus was obtained is striking, particularly since these cases were indistinguishable clinically from those in which no difficulty was encountered in establishing an etiological diagnosis and occurred simultaneously with them in each of the outbreaks.

DISCUSSION

The results of these studies covering a number of epidemics of influenza suggest that the etiology of this clinical syndrome is more diverse than had been realized previously. It seems evident, contrary to what might be expected, that more than one etiological variety of influenza may and often does occur in a single outbreak. The results of the serological studies which were carried out indicate clearly that while some cases in one epidemic were infected by influenza A virus but not by influenza B virus, other cases in the same epidemic were infected by influenza B virus but not by influenza A virus. The fact that in a few cases a specific antibody response to both viruses was demonstrated suggests that in these instances simultaneous or almost simultaneous infection by both agents occurred. The studies of throat washings from selected cases in the various epidemics serve to confirm the results of serological tests on the same cases. Ferrets or hamsters which responded to inoculation by the production of antibodies against influenza A virus or influenza B virus received in every instance throat washings from cases in which an antibody response against the homologous virus had been demonstrated. In no instance was the inoculation of a throat washing in ferrets or hamsters found to have stimulated the production of antibodies against both viruses.

Although evidence was obtained that a large proportion of all the cases studied in these epidemics were infected either by influenza A

virus or by influenza B virus, there remained in each epidemic an appreciable number of cases in which no evidence of infection by these agents could be demonstrated. It seems unreasonable to disregard these cases simply because a direct demonstration of a causal agent was not obtained. The fact that cases of this nature represented more than 30 percent of all the cases studied indicates that they were by no means of infrequent occurrence. Furthermore, since it was not possible to distinguish on clinical grounds between cases in this category and those in which evidence of infection by either influenza A or B virus was demonstrable, it appears obvious that the former cases should be considered to be examples of the clinical syndrome termed influenza with as much reason as the latter. This is particularly true since both varieties of cases occurred simultaneously in the same outbreaks. Since in these cases no increase in antibodies against either of the two known influenza viruses was demonstrable during convalescence, it seems logical to consider that infection by these agents had not occurred. The fact that throat washings from these cases, when inoculated into ferrets or hamsters, did not stimulate the production of antibodies against either virus may be taken as additional evidence that neither of these agents was associated with the disease.

On the basis of the completely negative laboratory data obtained in this series of cases, it seems logical to advance the hypothesis that there exists at least one additional infectious agent antigenically distinct from either influenza A virus or influenza B virus, which is capable of causing cases of influenza during epidemics of this disease. This hypothesis may be supported by the fact that throat washings from certain cases sometimes produced in ferrets fever and signs of respiratory infection similar to those caused by influenza A virus. Efforts to identify this hypothetical agent or to establish an etiological relationship to the human disease by means of neutralization tests in ferrets have been inconclusive so far. Furthermore, attempts to establish the agent in mice have not yet been successful.

If the available evidence does suggest the possibility that there is at least a third infectious agent capable of causing cases of influenza, it then becomes apparent that in some epidemics of the disease any one of at least three distinct causal agents may have been responsible for a certain proportion of the cases studied. In four of the outbreaks investigated during the past year there were some cases of influenza A, some of influenza B, and still others of a third variety which at the present time can only be termed influenza of unknown cause.

Under these circumstances it becomes exceedingly difficult to make any accurate assessment of the most common cause of cases in a particular epidemic of influenza unless a large number of cases is

studied by appropriate laboratory tests. The finding that some cases in a given epidemic have resulted from infection by influenza A virus does not now seem adequate evidence for the conclusion that the whole or even a major proportion of the epidemic was caused by this agent.

This difficulty is probably even more prominent in the study of a number of institutional outbreaks in a single epidemic since the somewhat abnormal conditions of confinement with consequent crowding may lead to increased contacts between inmates and therefore result in unusual exposure to infected individuals. As has been shown there were very marked differences in the proportion of cases studied which were caused by one or another of the two known viruses in two institutions in the same city during a single epidemic. How much of this variation in the etiology of the two outbreaks was apparent and due to chance sampling and how much was real, it is impossible to state. However, in the case of the seven institutional outbreaks in Alabama in which more than 67 percent of all clinical cases were studied there can be but little doubt that considerable variations in the proportions of influenza A and influenza of unknown cause actually occurred.

Whatever the coincidence of circumstances which initiate an epidemic of influenza, it seems likely that a number of variables influence its course and the distribution of the etiological agents responsible. If influenza A virus and influenza B virus are present and both produce cases at the same time, as apparently is not infrequently true, the number of cases due to either virus should be a function of the number of persons susceptible to infection by it and their chances of contact with it. Similar considerations should also be applicable to the hypothetical agent or agents responsible for cases of influenza of unknown cause.

SUMMARY

Studies of sera and throat washings obtained from numerous cases of influenza which occurred during three epidemic periods in 1 year have been carried out. In each epidemic period evidence was obtained that some cases were infected by influenza A virus and others by influenza B virus. In a considerable proportion of cases no evidence of infection by either virus was demonstrable. It is suggested that these cases resulted from infection by an agent or agents as yet unknown but distinct from either influenza A virus or influenza B virus. Since even in single institutional outbreaks cases of influenza A, influenza B, and influenza of unknown cause sometimes occurred simultaneously, it is suggested that epidemics of influenza may not infrequently be of diverse etiology.

REFERENCES

(1) Smith, W., Andrewes, C. H., and Laidlaw, P. P.: Lancet, **2:** 66 (1933).
(2) Horsfall, F. L., Jr., Lennette, E. H., Rickard, E. R., Andrewes, C. H., Smith, W., and Stuart-Harris, C. H.: Lancet, **2:** 413 (1940).
(3) Francis, T., Jr.: Am. J. Pub. Health, **27:** 211 (1937).
(4) Stuart-Harris, C. H., Smith, W., and Andrewes, C. H.: Lancet, **1:** 205 (1940).
(5) Rickard, E. R., Lennette, E. H., and Horsfall, F. L., Jr.: Pub. Health Rep., **55:** 2146 (1940).
(6) Magill, T. P.: Proc. Soc. Exp. Biol. and Med., **45:** 162 (1940).
(7) Francis, T., Jr.: Science, **92:** 405 (1940).
(8) Francis, T., Jr.: Proc. Soc. Exp. Biol. and Med., **45:** 861 (1940).
(9) Magill, T. P., and Tyndall, M.: Proc. Soc. Exp. Biol. and Med., **46:** 371 (1941).
(10) Francis, T., Jr.: Science, **80:** 457 (1934).
(11) Horsfall, F. L., Jr.: J. Exp. Med., **70:** 209 (1939).
(12) Horsfall, F. L., Jr.: J. Bact., **40:** 559 (1940).
(13) Horsfall, F. L., Jr., Hahn, R. G., and Rickard, E. R.: J. Clin. Invest., **19:** 379 (1940).
(14) Reed, L. J., and Muench, H.: Am. J. Hyg., **27:** 493 (1938).
(15) Horsfall, F. L., Jr., and Lennette, E. H.: J. Exp. Med., **73:** 327 (1941).
(16) Horsfall, F. L., Jr., and Bauer, J. H.: J. Bact., **40:** 569 (1940).
(17) Horsfall, F. L., Jr., Lennette, E. H., and Rickard, E. R.: J. Exp. Med., **73:** 335 (1941).

A NEW INDUSTRIAL SKIN CLEANSER

By LOUIS SCHWARTZ, *Medical Director, United States Public Health Service*

Harsh skin cleansers have frequently been found to be the actual causes of occupational dermatitis which before investigation seemed to have been caused by the chemicals manufactured or handled. Those workers who handle chemicals which are difficult to remove from the skin by ordinary toilet soaps are the ones mostly affected by dermatitis caused by skin cleansers. Synthetic dye workers, printers, dyers, workers with coal tar, pitch, asphalt, creosote oil, petroleum oils, greases, and soot are apt to use, for cleansing their hands after work, strongly alkaline and abrasive soaps which abrade and dissolve the superficial epithelium of the skin, volatile solvents which defat the skin, and powerful bleaching agents which cause chemical changes in the epithelium by chlorination and oxidation.

The damage to the skin caused by such harsh cleansers not only renders the skin more vulnerable to the action of irritant chemicals, but in many cases is the sole cause of occupational dermatitis.

Sulfonated oils, especially sulfonated vegetable oils, such as turkey red oil (an emulsion of a type of partially sulfonated castor oil and neutral soap), have long been used in industry. Recently, sulfonated vegetable oils have been used in the treatment of dermatitis.[1] Sulfonation of vegetable and mineral oils makes them emulsifying agents and they emulsify dirt and grease on the skin and help to cleanse it. Being miscible with water they can be used as skin cleansers and are

[1] Lane, C. Guy, and Blank, Irvin H.: Sulfonated oil as a detergent for diseases of the skin. Arch. Derm. and Syph., 43: 435 (March 1941).

of especial value in that the sulfonated vegetable oils do not defat the skin.

Sulfonated oils are made by mixing the oil in lead-lined vessels with 25–50 percent by weight of cold concentrated sulfuric acid, maintaining a temperature below 95° F. by slowly adding the acid. The oil is washed free from acid with sodium sulfate solution and then neutralized by the addition of an alkali, such as caustic soda or ammonia.

The degree of sulfonation and the method of neutralization influence the pH of the oil and the amount of SO_3 it contains, and determine its value as an industrial detergent and its suitability as a nonirritating, nondefatting skin cleanser.

A sulfonated vegetable or animal oil to be suitable for skin cleansing purposes should have a pH approximating that of the skin, but free from SO_3, have a fairly high fat content (about 50 percent), and be completely miscible with cold water.

Castor oil, coconut oil, olive oil, cottonseed oil, and other vegetable oils can all be sulfonated and made into useful skin cleansing compounds.

Petroleum oils can also be sulfonated, but they are not so good for the purpose of cleansing defatted or inflamed skins as are the sulfonated vegetable oils, because sulfonated petroleum oils themselves are fat solvents and the mineral oil contained in them does not replace the fatty matter lost by the skin. The mixing of sulfonated petroleum oils with sulfonated vegetable oils may increase their cleansing properties, but lessens their value as cleansers for dry, defatted skins.

The skin cleansing properties of the synthetic wetting agents, such as the fatty alcohol sulfates, have been known to dermatologists and cosmeticians for many years.[2] They work well even with hard waters and when mixed with soap or other foaming agents make excellent shampoos. These wetting agents, while superior to soap as pure cleansing agents, do defat the skin and may act as sensitizers. They are valuable in the treatment of certain diseases of the skin in which there is an excess of sebaceous or oily material in the skin. They can be manufactured so that their solutions have a wide latitude in hydrogen ion concentration and therefore can be used as "acid soaps" in cases of alkali sensitivity where ordinary alkali soaps are not tolerated.[3]

We have found that the defatting action of the wetting agents can be counteracted by mixing them with sulfonated animal or vegetable oils. We have made mixtures consisting of sulfonated castor oil having a pH of 7.2 and an oil content of 50 percent, with 2 percent of one of the wetting agents, Santomerse, Duponol, and Igepon, and

---

[2] Tersus, the proprietary name of a wetting agent first made in Germany, has been used for many years for the treatment of skin diseases and as a soap substitute.

[3] Duemling, Werner W.: Wetting agents. Arch. Derm. and Syph., 43: 264–278 (February 1941).

have found that it makes a good cleanser and does not defat the skin.[4]

The mixture is used in the same way as liquid soap, which it resembles in appearance, viz, a dram or two is put in the palm and rubbed into the skin and then washed off with water. The cleansing powers of this mixture can be increased without materially increasing its irritant properties by adding an alkali to it, such as trisodium phosphate 1–2 percent, or sodium hexameta phosphate in the same proportion. However, if the alkali is in excess it imparts a "sting" to the mixture, especially if it gets into cracks or abrasions of the skin.

This formula was first recommended by us to a large oil refining company for cleansing the hands of oil field workers whose skin had become inflamed from previously using kerosene to remove dirt and grease. These workers have used it sucessfully for over a year.

After a trial, this cleanser has also been installed in the wash rooms of a large plate printing establishment, where dermatitis (caused by strong cleansers used to remove dyes from the hands) has been constantly present for many years and where the use of this product has resulted in marked diminution of the number of new cases and a cure of most of the old ones.

In our skin clinic we have been prescribing this cleanser for several months for those cases of eczema and defatted skins in which soap and water are contraindicated and in which we have previously advised the use of olive oil as a cleanser. The results have been satisfactory in all cases. We have also had success with it in the treatment of atopic eczema in young children, several cases of which cleared up when the cleanser was used and recurred when soap was resumed.

When used as a skin cleanser in eczema, we do not advise the addition of alkali to the mixture because of its "stinging" properties.

When used as a skin cleanser in industrial establishments, workers who have had no dermatitis may object to the odor of the oil or complain that it does not foam as does soap, and some may state that they do not have to use it since their skins are not affected either by the chemicals which they handle or by the cleansers which they use. Therefore, it is suggested that a mild perfume such as lavender or lilac be added in sufficient quantity to hide the odor, and that, in those industrial establishments where dermatitis may occur from harsh cleansers used by the workers to remove extraneous matter from the hands, there should be installed in the wash rooms one or two outlets where this mixture of sulfonated castor oil and wetting agent is avaliable for the use of workers who are affected with dermatitis or with defatted skins. In this way workers whose skins are not affected by ordinary cleansers have their choice of using this mixture or other ordinary cleansers.

[4] There are many other wetting agents which may also be satisfactory. The following is a partial list of their trade names: Duponol, Gardinol, Alkanol, Merpol, Avirol, Nekal, Naccanol, Aerosol, Decerosol, Santomerse, Igepon, Triton, Orthopol, and Tergitol.

DISABLING SICKNESS AMONG 2,000 WHITE MALE GLASS WORKERS [1]

By William M. Gafafer, *Senior Statistician, United States Public Health Service*

INTRODUCTION

This is the tenth of a series of reports (*1–9*) from the Occupational Morbidity and Mortality Study, a study based principally on data transcribed from the membership records of industrial sick benefit organizations. The present report dealing with glass workers presents an analysis of absences lasting 8 days or longer that were accounted for by sickness and nonindustrial injuries, all of these absences beginning at some time during the 5 years, 1930–34.

The basic data are conveniently summarized in the following table:

Sex	Number of persons	Number of months of membership	Number of absences	Number of calendar days of disability	Number of deaths
Total	2,316	93,480	665	47,796	45
	White				
Male	2,169	88,125	597	42,432	36
Female	50	1,678	12	568	
	Negro				
Male	79	3,118	48	4,109	8
Female	2	120	2	24	
	Other				
Male	3	57	1	29	
Female	1	18	1	56	
	Unknown				
Male	12	364	4	578	1

For statistical purposes the group of white males is the one of choice, comprising as it does 94 percent of all members and accounting for an equal percentage of the total months of membership. The analyses, therefore, will be devoted exclusively to the experience of the white males.

Not all of the 2,169 white males selected for study were members of the sick benefit organizations for the entire period of 5 years. In fact, as is shown in the accompanying table, about one-third of the

[1] From the Division of Industrial Hygiene, National Institute of Health. References *10, 11,* and *12* contain informative material on the glass industry.

group belonged to an organization for 30 months or less, while about one-half of the group belonged for 55 or more months. It will be observed further that 999 were members for the entire 5 years.

Number and percent of workers	Number of months of membership in sick benefit organizations										
	Total	1-6	7-12	13-18	19-24	25-30	31-36	37-42	43-48	49-54	55-60	60
Number	2,169	289	161	112	87	81	89	89	96	102	1,063	999
Percent	100.0	13.3	7.4	5.2	4.0	3.8	4.1	4.1	4.4	4.7	49.0	46.0

For white males of all ages the average daily percentage disabled was 1.6. This percentage varied from 0.5 for persons under 25 years of age to 5.2 for those 65 years and over.

The requisite data on the degree, continuity, and length of the workers' exposure to specific environmental conditions, and materials for the determination of possible causes of differences among the morbidity rates are not available.[2]

The sick benefit organizations.—In the previous reports of the series reference was made to the fact that the regulations governing the payment of sick benefits influence the morbidity rates which are derived from the records of sick benefit organizations. As a rule these records do not deal with all disabilities which occur among the members nor with the total durations of all of the disabilities which are in the records.

The organizations under consideration operated under a group insurance plan. An applicant for membership must have one or more dependents and must have been an employee of the company for one year or more. Chronic ailments did not bar applicants from membership. A 7-day waiting period was in effect, meaning that 7 days must have elapsed between the onset of disability and the beginning of the payment of benefits. Illnesses, therefore, of less than 8 days' duration are not in the records. Benefits were paid for one illness of 26 weeks; when the disability continued beyond this maximum benefit period the insurance was cancelled. Upon his return to work the employee's insurance was again in force, the maximum benefit period being 52 weeks in any one year. The maximum benefit period introduces an understatement of the actual number of days lost per person per year, and the actual number of days per illness; these understatements are brought about by those disabilities extending beyond the termination of benefit payments. Finally, with respect to diagnosis a physician's certificate was required by the organizations before the payment of benefits was begun.

Grouping of occupations.—The wide variety of occupations, many of them with a relatively small number of person-years of membership, necessitated for purposes of analysis a grouping of the occupations into 8 groups as indicated in table 1. Similarity of work and of working environment were the bases of classification.

[2] In this connection the reader is referred to an editorial (*14*), and to pages 117-126 of reference ***15***.

TABLE 1.—*Specific occupations comprising each occupational group, white male employees in the glass industry, 1930–34, inclusive*

[Total person-years of membership: 7,343.8]

Occupational group	Specific occupation
Millwrights, repair and construction workers (1,003.4 person-years).	Apprentice, battery man, blacksmith, blacksmith's helper, bricklayer, bricklayer's helper, carpenter, carpenter's helper, electric welder, engineer, machinist's helper, millwright, millwright's helper, nailer, oiler, painter, pipefitter, pipefitter's helper, plasterer, pumpman, repairman, repairman's helper, roof repairman, sheet metal worker, structure worker, tinner, truck repair helper, welder.
Cutters and examiners (984.7 person-years).	Cutters, examiners, re-examination classifiers.
Packers and shippers (868.9 person-years).	Carrier, crane follower, laborer, loader, packer, paper cutter machine man, pin maker, rack man, stockman, stower, truck operator, truck operator's helper.
Finishers (678.4 person-years).	Car man, mixer, roll tender, rouge tender, stripper.
Grinders (658.5 person-years).	Finisher, layer.
Batch mixers, furnace and casting workers (601.7 person-years).	Ash handler, batch mixer, boiler fireman, coal wheeler, crane operator, cullet washer, laboratory man and caster, lehr tender, miscellaneous worker, mixer, pot maker, weigher.
Outside workers (489.5 person-years).	Brakeman, deck hand, engineer, fireman, helper, hostler, laborer, shovel operator, switchman, truck driver, truckman.
All others (2,058.7 person-years).	Apprentice, assistant superintendent, attendant, barber, booker, cafeteria helper, cleaner, clean-up, clerk, conductor, craneman, electrician, electrician's helper, engineer, farm boss, feeder, foreman, gas maker, glass cleaner ground keeper and gardener, janitor, laborer, machine operator, machinist motorman, patrolman, pot shell picker, stop maker, substation operator' tool and die maker, tool room attendant, traffic manager, tuile house boss watcher, watchman, water tender, window cleaner, unknown.

ANALYSIS OF THE DATA

Age composition of the occupational groups.—Table 2 shows the percentage age distribution of the person-years of membership in the sick benefit organizations for specific occupational groups. For purposes of comparison there has been added the percentage age distribution of all gainful white male workers in the United States. When the two distributions are compared it will be observed that the sample under study is represented by relatively fewer persons 55 years and over, and about the same proportion of persons under 35 years of age. Both distributions show approximately the same percentage of persons in the age group 35 years and over.

TABLE 2.—*Percentage distribution of person-years of membership by age, according to occupational group, white male employees in the glass industry, 1930–34, inclusive*

Occupational group [1]	All known ages (100 percent)	Age in years as of July 1, 1932: Under 25	25–34	35–44	45–54	55–64	65 and over
All gainful white male workers in the United States [2]	*33,766,933*	*19.7*	*24.0*	*22.9*	*17.4*	*10.7*	*5.3*
All occupations, present study	7,317.3	11.7	31.9	25.0	20.6	8.7	2.1
Millwrights, repair and construction workers	992.7	5.7	27.6	30.6	25.7	8.7	1.7
Cutters and examiners	984.7	22.9	45.9	19.7	7.2	3.4	.9
Packers and shippers	858.9	8.1	26.8	26.1	30.4	7.4	1.2
Finishers	678.4	19.4	34.7	22.1	18.3	4.3	1.2
Grinders	653.8	16.7	32.6	19.3	20.9	8.2	2.3
Batch mixers, furnace and casting workers	601.7	7.8	25.2	30.7	22.1	13.1	1.1
Outside workers	488.5	4.6	29.2	17.5	26.9	19.9	1.9
All others	2,058.6	9.3	30.9	27.1	19.4	9.3	4.0

[1] See table 1.
[2] Reference (*13*).

With regard to the percentage age distributions of particular occupational groups it will be noted that cutters and examiners under 35 years of age yield a percentage of 68.8 as compared with 43.6 for all occupations. The other occupational groups filled by younger men are finishers and grinders. Persons in the two occupational groups, batch mixers, furnace and casting workers, and outside workers, appear to be relatively older with 14.2 and 21.8 percent, respectively, in the age group 55 years and over.

Indexes of morbidity by age and diagnosis groups.—Table 3 presents the frequency, disability, and severity rates specific for age group and broad diagnosis group. The table shows a total frequency (age-standardized) of 82.8 absences per 1,000 workers, the nonrespiratory-nondigestive group of diseases, with a frequency of 35.4 contributing the largest number of absences; the next highest frequency, that for the respiratory group, is about one-third less, or 24.0. The frequencies for the remaining groups, nonindustrial injuries and digestive diseases, are approximately the same, 12.3 and 10.7, respectively. So far as frequency of absence because of illness is concerned the experience of the glass workers compares favorably with that of a group of approximately 170,000 male industrial workers. Reports to the United States Public Health Service on this group of workers yielded frequencies for 1930–34 as follows, the corresponding data for the glass workers being in parentheses: All diagnoses 89.3 (82.8), nonindustrial injuries 12.2 (12.3), respiratory diseases 31.5 (24.0), digestive diseases 13.2 (10.7), and nonrespiratory-nondigestive diseases 32.4 (35.4). It will be observed that the difference between the total frequencies reflects largely the behavior of the respiratory group.

The average annual number of days lost per person from all disabilities is 6.11. Again the largest contributor is the nonrespiratory-nondigestive group which accounts for about one-half of the total disability rate. Respiratory diseases, on the other hand, yielded 1.4 days, and digestive diseases and nonindustrial injuries 0.94 and 0.66, respectively.

The severity rate, average number of days per absence, presents less variability than either of the other two indexes. The rate for all diagnoses is 73.8 days per absence. The rates for digestive diseases and nonrespiratory-nondigestive diseases approximate each other with 88.2 and 87.1, respectively. Similarly, the remaining groups, respiratory diseases and nonindustrial injuries, approximate each other with 58.1 and 53.9, respectively. Thus while the group of digestive diseases yields the lowest frequency (10.7) of all four groups of diagnoses, this particular group of diseases accounts, on the average, for absences of longest duration (88.2 days).

TABLE 3.—*Indexes of morbidity for different age groups according to broad cause group, white male employees in the glass industry, 1930–34, inclusive*

Diagnosis group	All ages [1]		Age in years as of July 1, 1932					
	Standardized [2]	Crude	Under 25	25–34	35–44	45–54	55–64	65 and over
	Annual number of absences per 1,000 males [3]							
Total, all diagnoses [4]	82.8	81.3	46.9	68.5	93.6	82.7	113.6	172.9
Nonindustrial injuries	12.3	12.4	12.9	12.8	15.3	8.6	6.3	19.2
Respiratory diseases	24.0	24.1	10.6	24.0	27.4	19.9	41.0	38.4
Digestive diseases	10.7	10.9	7.0	11.6	10.4	13.2	7.9	19.2
Nonrespiratory-nondigestive diseases	35.4	33.5	16.4	19.7	40.0	41.0	56.8	96.1
	Annual number of days of disability per male							
Total, all diagnoses [4]	6.11	5.78	1.87	4.38	6.70	5.45	11.22	19.07
Nonindustrial injuries	.66	.67	.29	.72	.81	.50	.67	1.69
Respiratory diseases	1.39	1.34	.29	1.16	1.65	.94	2.93	3.84
Digestive diseases	.94	.94	.43	1.01	.95	.98	.93	2.43
Nonrespiratory-nondigestive diseases	3.08	2.79	.87	1.40	3.27	3.03	6.64	11.11
	Average number of days per absence [5]							
Total, all diagnoses [4]	73.8	71.1	40.0	63.9	71.6	65.9	98.8	110.3
Nonindustrial injuries	53.9	53.8	22.2	55.9	52.9	58.5	105.5	88.0
Respiratory diseases	58.1	55.7	27.0	48.6	60.2	47.4	71.5	100.0
Digestive diseases	88.2	86.4	61.8	87.3	91.2	74.2	118.2	126.3
Nonrespiratory-nondigestive diseases	87.1	83.4	52.9	71.3	81.9	73.8	116.9	115.7
	Number of 8-day or longer absences which began during 1930–34, inclusive							
Total, all diagnoses [4]	597		40	160	171	125	72	27
Nonindustrial injuries	91		11	30	28	13	4	3
Respiratory diseases	177		9	56	50	30	26	6
Digestive diseases	80		6	27	19	20	5	3
Nonrespiratory-nondigestive diseases	246		14	46	73	62	36	15
	Number of calendar days of disability							
Total, all diagnoses [4]	42,432		1,598	10,218	12,241	8,240	7,111	2,978
Nonindustrial injuries	4,893		244	1,676	1,481	760	422	264
Respiratory diseases	9,851		243	2,719	3,009	1,421	1,859	600
Digestive diseases	6,912		371	2,356	1,732	1,483	591	379
Nonrespiratory-nondigestive diseases	20,512		740	3,278	5,976	4,576	4,207	1,735
	Number of deaths							
Total, all diagnoses	36		1	5	2	12	10	6
Number of person-years of membership	7,343.8		853.6	2,335.3	1,826.8	1,511.7	633.7	156.2

[1] Includes a negligible number of persons of unknown age.
[2] Age-standardized according to the total gainfully employed white male workers in the United States (13, p. 117).
[3] Absences include only those which began during the study period, but days of disability include days for absences which began prior to, as well as during, the study period. This seeming excess of days of disability is compensated in part by the fact that days subsequent to 1934 are not included, even though some absences had not ended or reached 189 days at the close of the study period.
[4] Includes a negligible number of cases of ill-defined or unknown diagnosis.
[5] Includes all days of disability during the study period, regardless of when the disability began. Disabilities which reached 189 days were arbitrarily terminated at 189 days by the regulations of the sick benefit organizations.

Of considerable interest are the changes in the indexes with age. In general each index shows an increase for each cause group in passing from the youngest age group to the oldest. Thus for all diagnoses the frequency increases from 46.9 to 172.9, the disability rate from 1.87 days per worker to 19.07, and the severity rate from 40.0 days per absence to 110.3. Attention is also directed to the fact that for each index the movement of the nonrespiratory-nondigestive group of diseases approximately parallels that of all diagnoses; when the rates are presented graphically the curves show with respect to each index that the same cause group (nonrespiratory-nondigestive diseases) lies closest to the curve of all diagnoses. Thus the nonrespiratory-nondigestive group is an important determining factor in the behavior of the three indexes representing all diagnoses.

Rheumatic diseases.[3]—While the magnitude of the available data precludes a statistical analysis by specific cause, the findings in connection with the rheumatic group of diseases are of no little interest. An examination of the number of days of disability according to cause reveals that of the total of 42,432 days for the 5 years, 6,596, or 15.5 percent, were accounted for by the rheumatic diseases. Moreover, this group of diseases was responsible for 76 of the grand total of 597 cases, or 12.7 percent. These findings are of considerable interest when compared with certain unpublished material in the Division of Industrial Hygiene. This material, based on over 200,000 male-years of exposure, yielded cases of rheumatic diseases which accounted for 10.3 percent of the total days of disability and 9.3 percent of the total number of cases experienced. While the number of cases of rheumatic diseases in the present experience is lower than that recorded for influenza and grippe (96), and for nonindustrial injuries (91), the number of days disabled because of the rheumatic diseases ranks first with a total over 50 percent in excess of the days accounted for by influenza and grippe (4,007).

Morbidity by broad diagnosis group and occupation.—Table 4 presents the material with the specific occupational groups arranged in order of decreasing magnitude of person-years of membership. An examination of the occupationally specific rates covering all causes reveals three occupational groups of particular interest. These three groups, comprising grinders, outside workers, and finishers, have the highest frequency of absences as well as the largest number of days lost and absences of longest average duration. Thus these 3 groups have not only a relatively large number of disabilities each year but the disabilities are on the average more severe than those for the entire group of workers. It is of interest to observe that the outside workers show all three indexes to be relatively high for either the respiratory or the nonrespiratory diseases. Finishers, on the other hand, show indexes

[3] This group includes acute and chronic rheumatism, lumbago, neuritis, and sciatica.

below the average for the entire group of workers with respect to the respiratory diseases but above the average for the nonrespiratory diseases. Grinders yield indexes above the average with respect to nonrespiratory diseases, and while this occupational group experienced a low frequency of respiratory diseases the disability and severity rates were above the average for the entire group of workers. Attention is also directed to the group, millwrights, repair and construction workers, which shows for the respiratory diseases all three indexes above the average. Finally, the occupational group, batch mixers, furnace and casting workers, shows a relatively low frequency of respiratory diseases but a long average duration of cases.

TABLE 4.—*Indexes of morbidity for different broad cause groups according to occupational group, white male employees in the glass industry, 1930–34, inclusive*

Occupational group [1]	Annual number of absences per 1,000 males		Annual number of days of disability per male		Average number of days per absence		Number of 8-day or longer absences	Number of calendar days of disability	Number of person-years of membership
	Standardized [2]	Crude	Standardized [2]	Crude	Standardized [2]	Crude			
	All sickness and nonindustrial injuries								
All occupations	82.8	81.3	6.11	5.78	73.8	71.1	597	42,432	7,343.8
Millwrights, repair and construction workers	86.2	87.7	5.26	5.22	61.0	59.5	88	5,237	1,003.4
Cutters and examiners	78.2	68.0	5.61	4.31	71.7	63.4	67	4,247	984.7
Packers and shippers	89.3	88.6	6.34	6.01	71.0	67.8	77	5,218	868.9
Finishers	93.6	85.5	7.46	6.19	79.7	72.4	58	4,201	678.4
Grinders	103.7	98.7	8.48	7.67	81.7	77.7	65	5,048	658.5
Batch mixers, furnace and casting workers	65.0	66.5	4.37	4.42	67.2	66.6	40	2,662	601.7
Outside workers	101.5	106.2	9.96	10.75	98.2	101.2	52	5,264	489.5
All others	71.5	72.9	5.05	5.13	70.6	70.4	150	10,555	2,058.7
	Respiratory diseases								
All occupations	24.0	24.1	1.39	1.34	58.1	55.7	177	9,851	7,343.8
Millwrights, repair and construction workers	27.8	28.9	1.76	1.77	63.2	61.1	29	1,773	1,003.4
Cutters and examiners	20.0	18.3	1.08	.49	54.1	26.6	18	479	984.7
Packers and shippers	24.2	24.2	1.20	1.13	49.4	46.6	21	978	868.9
Finishers	22.2	20.6	1.04	.87	46.7	42.0	14	588	678.4
Grinders	23.5	22.8	1.64	1.49	69.8	65.6	15	984	658.5
Batch mixers, furnace and casting workers	17.2	18.3	1.25	1.30	72.4	71.2	11	783	601.7
Outside workers	35.1	38.8	3.32	3.69	94.5	95.1	19	1,807	489.5
All others	23.3	24.3	1.15	1.19	49.5	49.2	50	2,450	2,058.7
	Nonrespiratory diseases								
All occupations	46.1	44.4	4.03	3.73	87.3	84.1	326	27,424	7,343.8
Millwrights, repair and construction workers	41.2	41.9	2.70	2.65	65.6	63.4	42	2,662	1,003.4
Cutters and examiners	45.9	36.6	4.26	3.08	92.9	84.2	36	3,030	984.7
Packers and shippers	50.6	50.6	4.45	4.20	88.0	82.9	44	3,647	868.9
Finishers	56.9	50.1	5.88	4.74	103.4	94.6	34	3,215	678.4
Grinders	56.9	53.2	5.64	5.03	99.1	94.6	35	3,310	658.5
Batch mixers, furnace and casting workers	40.8	41.5	2.89	2.90	70.9	69.7	25	1,742	601.7
Outside workers	63.8	67.4	5.90	6.37	92.4	94.4	33	3,116	489.5
All others	37.0	37.4	3.25	3.26	87.8	87.0	77	6,702	2,058.7

[1] See table 1.
[2] Age standardized according to the total gainfully employed white male workers in the United States (*15*, p. 117).

SUMMARY

This report deals with sickness and nonindustrial injuries causing disability lasting 8 calendar days or longer among approximately 2,000 white male workers in the glass industry during the 5 years, 1930–34.

The frequency of disability by broad diagnosis groups compares favorably with that experienced by 170,000 male industrial workers.

The number of days of disability because of the rheumatic diseases was over 50 percent greater than the number accounted for by influenza and grippe.

Grinders, outside workers, and finishers experienced frequency, disability, and severity rates well above the average for the entire group of workers.

REFERENCES

PAPERS FROM THE OCCUPATIONAL MORBIDITY AND MORTALITY STUDY

(*1*) Sayers, R. R., DallaValle, J. M., and Bloomfield, S. G.: Occupational and environmental analysis of the cement, clay, and pottery industries. Pub. Health Bull. No. 238. United States Government Printing Office, 1937.

(*2*) Sayers, R. R., Kroeger, Gertrud, and Gafafer, W. M.: General aspects and functions of the sick benefit organization. Pub. Health Rep., **52**: 1563–1580 (1937). (Reprint No. 1874.)

(*3*) Gafafer, W. M.: Frequency of sickness and nonindustrial accidents causing disability lasting eight calendar days or longer among 60,000 white male railroad employees, 1930–34, inclusive. Pub. Health Rep., **53**: 555–573 (1938). (Reprint No. 1924.)

(*4*) Brinton, H. P.: Disabling sickness and nonindustrial injuries among drivers and other employees of certain bus and cab companies, 1930–34, inclusive. Pub. Health Rep., **54**: 459–468 (1939). (Reprint No. 2049.)

(*5*) Brinton, H. P., and Seifert, H. E.: Disabling morbidity among employees in the soap industry, 1930–34, inclusive. Pub. Health Rep., **54**: 1301–1316 (1939). (Reprint No. 2093.)

(*6*) Seifert, H. E.: The coding of occupations for machine tabulating purposes with reference principally to studies on occupational morbidity. J. Ind. Hyg., **21**: 246–255 (1939).

(*7*) Brinton, H. P.: Disabling morbidity, and mortality among white and Negro male employees in the slaughter and meat packing industry, 1930–34, inclusive. Pub. Health Rep., **54**: 1965–1977 (1939). (Reprint No. 2111.)

(*8*) Brinton, H. P., Seifert, H. E., and Frasier, Elizabeth S.: Disabling morbidity among employees in the slaughter and meat packing industry, 1930–34, inclusive. Pub. Health Rep., **54**: 2196–2219 (1939). (Reprint No. 2119.).

(*9*) Brinton, H. P., and Frasier, Elizabeth S.: Disabling morbidity among male and female employees in mail-order stores, 1930–34, inclusive. Pub. Health Rep., **55**: 1163–1178 (1940).

OTHER REFERENCES

(*10*) Scholes, S. R.: Modern Glass Practice. Industrial Publications, Inc., Chicago, 1935.

(*10a*) Scholes, S. R.: Handbook of the Glass Industry. The Glass Industry, New York [1940].

(*11*) Marson, P., and Angus-Butterworth, L. M.: Glass and Glass Manufacture. Pitman and Sons, Ltd., London, 1936.

(*12*) West Virginia State Health Department, Bureau of Industrial Hygiene: A report on the glass industry in West Virginia. West Virginia State Health Department, Charleston. (Mimeographed, ca. 1938.)

(13) U. S. Department of Commerce, Bureau of the Census: Fifteenth Census of the United States. Population, vol. 5, General Report on Occupations, United States Government Printing Office, 1933. P. 117.
(14) Editorial: Occupation and mortality. Lancet, 1: 1174-1175 (May 21, 1938).
(15) Greenwood, M.: Epidemics and Crowd-Diseases, An Introduction to the Study of Epidemiology. Williams and Norgate, Ltd., London [1935.]

ORNITHODOROS TURICATA: THE MALE; FEEDING AND COPULATION HABITS, FERTILITY, SPAN OF LIFE, AND THE TRANSMISSION OF RELAPSING FEVER SPIROCHETES[1]

By GORDON E. DAVIS, *Bacteriologist, United States Public Health Service*

In 1937 a series of 12 *O. turicata* males that had been reared individually from the egg in shell vials was selected for observations concerning feeding, copulation, fertility, span of life, and the transmission of relapsing fever spirochetes. In the nymphal stages 8 of these ticks had been allowed to feed on rats infected with a Kansas strain of spirochetes, 2 on rats infected with a Texas strain of spirochetes, and 1 had acquired a Kansas strain through the egg.

Feeding habits.—When placed on an appropriate host at regular intervals and allowed to engorge completely, the male will feed every 3 or 4 weeks. It becomes as fully distended with blood as the female or any of the immature stages. The time required for engorgement, i. e., from the time of attachment to that of voluntary detachment, has been determined for 100 feedings. When the tick is completely engorged the integument has a shiny appearance and coxal fluid may be exuded on the host. Ticks which detached as the result of quick movements of the host and those which remained attached after complete engorgement were not considered. When the tick is detached before complete engorgement, no coxal fluid is exuded and if it remains attached after complete engorgement, there has been a deflation coincident to the exudation of the fluid.

Table 1 shows the time in minutes required for complete engorgement. Observations on individual ticks varied from 4 to 13, according to the opportunity available at the time of feeding. The shortest feeding period was 6 minutes and the longest 23 minutes. The rate of filling depends to some extent on the site of attachment.

TABLE 1.—*O. turicata males: Feeding time in minutes*

Time in minutes	6-10	10-15	16-20	20-23
Number of observations	18	62	16	4

[1] Contribution from the Rocky Mountain Laboratory, Hamilton, Mont., Division of Infectious Diseases, National Institute of Health.

Copulation time (table 2).—Copulation time is considered as the period which elapses between attachment of the male to the female and the appearance of the spermatophore, with the consequent voluntary removal of the male from the mating position. Again there were 100 observations made and from 4 to 13 timings on individual ticks. The shortest period was 12 minutes and the longest 60 minutes.

TABLE 2.—*O. turicata males: Copulation time in minutes*

Time in minutes	12-15	16-20	21-25	26-30	31-35	36-40	41-45	46-60	51-55	56-60
Number of copulations	9	15	21	21	16	3	6	6	2	1

TABLE 3.—*A comparison of the fertility of virgin and "old" males when allowed to copulate with virgin females*

"OLD" MALES

♂ Tick No.	Following feeding	Copulation	Number eggs deposited	Number of larvae	Fertility percentage
5	23d	20th	309	233	
31	20th	16th	92	4	
8	17th	16th	86	20	
6	20th	18th	201	161	
6	21st	19th	121	59	
5	24th	21st	209	126	
31	21st	17th	244	198	
17K	18th	13th	257	207	
28	21st	19th	175	91	
8	18th	17th	237	226	
Total			1,931	1,325	68

VIRGIN MALES

♂ Tick No.	Following feeding	Copulation	Number eggs deposited	Number of larvae	Fertility percentage
42		None	252	112	
17		None	121	26	
16		None	213	121	
6		None	131	74	
25		None	169	130	
33		None	232	79	
48		None	42	42	
52		None	138	39	
22		None	257	196	
7		None	254	98	
37		None	81	54	
43		None	148	67	
4		None	116	63	
13		None	145	119	
Total			2,299	1,220	53

Fertility (table 3).—It might be assumed that the fertility of the older males is less than that of the younger ones. However, observations do not bear out this assumption. Following mating of 14 virgin males and females a total of 2,299 eggs were deposited, resulting in 1,220 larvae, or a fertility rate of 53 percent. Following the mating of 10 "old" males and virgin females a total of 1,931 eggs were deposited, resulting in 1,325 larvae, a fertility rate of 68 percent. Subsequent to this test, male No. 28, at its twenty-eighth mating, copulated with a virgin female, resulting in 111 eggs and 82 larvae, a fertility rate of 73.8 percent. At the twenty-ninth copulation this

male again mated with a virgin female. There was deposition of 173 eggs of which 164 hatched, a fertility rate of 95 percent.

Transmission of spirochetes.—The male, as well as the female and the immature forms, transmits relapsing fever spirochetes, although they are not necessarily transmitted at each feeding. In a total of 242 test feedings spirochetes were transmitted 180 times. Four ticks were successful in transmission at each feeding, viz, 7, 13, 20, and 23 times, respectively, and 7 were irregular. One tick (No. 6) transmitted spirochetes 7 times in the first 8 feedings, but failed in 21 additional test feedings.

Sexual transmission.—Six sexual transmission experiments were each initiated by allowing virgin females which had failed to transmit spirochetes in any of the nymphal stages to copulate with males which had been repeatedly successful in the transmission of spirochetes. Eleven males were used, 4 of which were carrying a Texas strain of spirochetes and 7 a Kansas strain.

A total of 22 test feedings of the 6 females, following a total of 22 matings with the above males, failed to infect white mice or young white rats. Progeny of these females were also tested as follows: 789 in the larval stage, 289 in the larval and first nymphal stages, and 151 in the larval and first and second nymphal stages. Spirochetes were not demonstrated in the blood of any of the test animals.

Longevity.—Length of life was determined on 11 males stored in humidity jars at a varying laboratory temperature. Under these conditions the span of life of the 11 was 15, 18, 22, 23, 26, 29, 30, 30, 34, 35, and 36 months. One tick (No. 28) remains alive after 36 months and feeds and mates normally. (See record under fertility.) Francis has recently reported the survival of male *turicata* for 6 years and 8 months.

Table 4 summarizes the span of adult life, the number of adult feedings, the number of spirochetal transmissions, and the number of copulations for each of the 11 ticks.

TABLE 4.—*O. turicata males; span of life, number of feedings, spirochete transmissions, and copulations*

Tick number	Infective feeding	First adult feeding	Span of adult life in months	Number of adult feedings	Number of transmissions	Number of copulations
36	Dec. 15, 1936	Sept. 17, 1937	[1] 12	7	7	5
28	Feb. 3, 1937	Aug. 31, 1937	36+	30	19	30
5	Dec. 15, 1936	July 6, 1937	28	27	22	23
17T	Feb. 3, 1937	Aug. 31, 1937	23	23	23	17
6	Dec. 15, 1936	July 6, 1937	35	29	7	23
7	Mar. 8, 1937	Aug. 26, 1937	22	20	20	21
17K	Dec. 15, 1936	Sept. 22, 1937	25	21	16	16
43	do	Oct. 8, 1937	18	12	9	10
21	do	July 6, 1937	18	12	8	13
31	Dec. 7, 1936	July 7, 1937	34	27	18	19
8	Dec. 15, 1936	Mar. 5, 1937	30	21	18	20
3	[2]	Oct. 15, 1937	15	13	13	13

[1] Lost in transportation. [2] Transovarial transmission.

DISCUSSION

It is obvious that this study was made under artificial conditions. However, it does present a relative idea of several biological phases of the male *turicata*. The span of life as determined under laboratory conditions may be longer or shorter than under natural conditions. Temperature and humidity are two important factors, the natural conditions of which are not easily duplicated in the laboratory. In nature the surface temperature may be very high while a few inches beneath the surface the sandy burrows are cool and moist, as noted in southwestern Kansas and the sand dunes of northern Oklahoma. (In the laboratory all larvae under test have survived the molting period in a humidity jar (saturated ammonium chloride) at temperature of 80° F., thus indicating that in the early stages this species may survive a fairly high temperature.)

In the experimental work the males were used for mating at intervals of 3 to 4 days, but under natural conditions it is possible that they are able to copulate at more frequent intervals. That spirochetes may be transmitted more frequently than indicated by the records is suggested by the facts that transmission can be effected in less than 1 minute and that the male is at times rather easily dislodged and blood meals, therefore, are probably taken rather frequently.

SUMMARY

1. Twelve male *O. turicata* were observed for feeding and copulation habits, the transmission of relapsing fever spirochetes, span of life, and for fertility as "old" males in comparison with young males.
2. Based on 100 observations, time for complete engorgement varied from 6 to 23 minutes.
3. Based on 100 observations, the time required to complete the act of mating varied from 12 to 60 minutes, with the majority falling between 21 and 35 minutes.
4. The male may transmit spirochetes at each feeding throughout life; it may transmit them irregularly or, after several successive transmissions, it may fail to effect further transmissions.
5. A comparison of the fertility of virgin males and "old" males suggests that mating of the latter results in a larger proportion of fertile eggs.
6. Test feedings of 6 females (a total of 22 feedings) after each mating with spirochete-carrying males and 1,229 test feedings of the progeny of these matings failed to infect white mice.
7. The span of adult male life under laboratory conditions varied from 15 to over 36 months.

REFERENCE

Francis, Edward: Longevity of the tick *Ornithodoros turicata* and of *Spirochaeta recurrentis* within this tick. Pub. Health Rep., **53**: 2220–41 (1938).

TWO STRAINS OF ENDEMIC TYPHUS FEVER VIRUS ISOLATED FROM NATURALLY INFECTED CHICKEN FLEAS (*ECHIDNOPHAGA GALLINACEA*)[1]

By GEORGE D. BRIGHAM, *Associate Bacteriologist, United States Public Health Service*

The virus of endemic typhus fever has been recovered in nature or transmitted experimentally in several species of fleas. However, no mention has been made of its recovery from the chicken flea (*Echidnophaga gallinacea*). We can now report the recovery of endemic typhus fever virus from naturally infected chicken fleas.

The first strain was isolated from a pool of 135 chicken fleas removed from two Norway rats trapped on a farm in Georgia in May 1939. The owner of the farm was sick at the time with a typical case of endemic typhus fever.[2] Additional strains of endemic typhus virus were recovered from the pooled brains of the two rats as well as from pools of 5 *X. cheopis* and 7 *L. segnis* fleas combed from these rats.

The strain isolated from chicken fleas was shown to be endemic typhus virus by passage through fourteen guinea pig generations, 53 guinea pigs being used; 42 of these animals developed clinical endemic typhus with scrotal reactions, 2 developed fever only; 7 showed no evidence of infection, although 5 of the 7 were found to be immune; 2 died of secondary infections. Cross-immunity with three known endemic typhus fever strains was demonstrated. Rickettsiae were found in smears from the tunica vaginalis of the passage guinea pigs. Senior Surgeon R. D. Lillie reported the brains of 5 passage guinea pigs positive for the characteristic typhus lesions. Two rabbits inoculated with this strain produced agglutinins for Proteus OX_{19}.

In September 1939 the City Health Officer of Albany, Ga., submitted for examination a rat[3] which had been shot coming out of a chicken yard in the residential section of the city. *Echidnophaga gallinacea* were the only fleas recovered from this rat. A strain of typhus was recovered from the brain and from a pool of 30 chicken fleas combed from the rodent.

We carried this flea strain through twelve generations of guinea pigs, 49 guinea pigs being used. Of the 49 animals, 39 produced clinical endemic typhus with scrotal reactions; 6 developed fever only; 2 showed no evidence of infection although they were found to

[1] From the Typhus Research Laboratory, Savannah, Ga., Division of Infectious Diseases, National Institute of Health.

[2] Acknowledgment is made to Dr. R. R. Holt, Parrott, Ga., and to Dr. C. A. Henderson, County Health Commissioner, Terrell County, Ga., for reporting the case to the Laboratory, and to Dr. James Watt, Passed Assistant Surgeon, U. S. Public Health Service, for assistance in trapping the rats.

[3] This rat was apparently a cross between the domestic white and the wild Norway species as the color pattern showed white flanks and abdomen with a definite Norway colored head and stripe extending down the back and including the tail. Several rats of this color pattern had been trapped in Albany from time to time.

be immune; 2 died of secondary infections. Cross-immunity was complete with four other strains of endemic typhus fever including the other chicken flea strain. Rickettsiae were demonstrated in smears from the tunica vaginalis. Senior Surgeon R. D. Lillie reported characteristic typhus lesions present in the brains of 6 passage guinea pigs. Agglutinins for Proteus OX_{19} were produced in two rabbits inoculated with this strain.

DEATHS DURING WEEK ENDED AUGUST 23, 1941

[From the Weekly Mortality Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended Aug. 23, 1941	Corresponding week, 1940
Data from 88 large cities of the United States:		
Total deaths	7,068	7,063
Average for 3 prior years	7,029	
Total deaths, first 34 weeks of year	292,073	282,741
Deaths per 1,000 population, first 34 weeks of year, annual rate	12.0	12.0
Deaths under 1 year of age	459	476
Average for 3 prior years	497	
Deaths under 1 year of age, first 34 weeks of year	17,845	17,102
Data from industrial insurance companies:		
Policies in force	64,428,243	64,973,192
Number of death claims	10,800	10,997
Death claims per 1,000 policies in force, annual rate	8.7	8.8
Death claims per 1,000 policies, first 34 weeks of year, annual rate	9.8	10.0

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED AUGUST 30, 1941

Summary

A total of 624 cases of poliomyelitis was reported during the current week as compared with 611 cases for the preceding week. The rate of increase was only 2 percent as compared with 11 percent for the preceding week, and with 30 percent for the next earlier week. A decreased incidence was shown generally in the southern area, while the most significant increases were recorded for the northern areas, especially the New England and North Central States.

The following named 13 States reported 15 or more cases during the current week (last week's figures in parentheses): New York 69 (66); Alabama 65 (78); Pennsylvania 65 (82); Georgia 50 (74); Ohio 36 (44); Maryland 32 (21); Illinois 31 (23); New Jersey 29 (25); Tennessee 29 (39); Massachusetts 21 (8); Minnesota 21 (14); Florida 16 (14); Kentucky 15 (25). A total of 4,025 cases has been reported this year to date (first 35 weeks) as compared with 4,695 for the corresponding period in 1937, in which year the incidence was the highest for this period during the 5 years, 1936–40.

For the second week the incidence of encephalitis has declined in the North Central States. Following are the numbers of cases reported currently (with last week's figures in parentheses): North Dakota 98 (120); South Dakota 13 (38); Minnesota 51 (95). Colorado reported 32 cases as compared with 20 for the preceding week. There has been a preponderance of cases among males in the rural population. Preliminary epidemiological data suggest a rapidly traveling mode of spread and widespread reservoir of infection. Cases of encephalomyelitis in horses are reported to occur principally in young, unvaccinated animals.

During the week plague infection was again reported found in fleas from ground squirrels in Siskiyou County, Calif.

Of 21 cases of Rocky Mountain spotted fever, only 2 cases were reported in the Rocky Mountain area; and of 70 cases of endemic typhus fever, 28 cases occurred in Georgia and 22 in Texas.

The death rate for the current week in 88 large cities in the United States was 9.9 per 1,000 population, the same as for the preceding week and the same as the 3-year (1938–40) average. The cumulative rate to date (first 35 weeks) is 11.9 as compared with 12.0 for the same period last year.

Telegraphic morbidity reports from State health officers for the week ended August 30, 1941, and comparison with corresponding week of 1949 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that, although none were reported, cases may have occurred.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended		Median 1936-40	Week ended		Median 1936-40	Week ended		Median 1936-40	Week ended		Median 1936-40
	Aug. 30, 1941	Aug. 31, 1940		Aug. 30, 1941	Aug. 31, 1940		Aug. 30, 1941	Aug. 31, 1940		Aug. 30, 1941	Aug. 31, 1940	
NEW ENG.												
Maine	2	0	1	------	------	------	15	3	3	0	0	0
New Hampshire	0	0	0	------	------	------	0	0	0	0	0	0
Vermont	0	0	0	------	------	------	4	2	------	0	0	0
Massachusetts	1	1	3	------	------	------	38	52	27	1	0	0
Rhode Island	1	0	0	------	------	------	3	2	2	0	0	0
Connecticut	0	0	1	------	1	1	13	6	4	0	0	0
MID. ATL.												
New York	10	5	8	[1] 0	[1] 6	[1] 1	57	128	75	2	1	2
New Jersey [2]	3	1	1	3	------	------	20	27	20	0	1	1
Pennsylvania	7	4	12	1	------	------	69	39	47	2	1	4
E. NO. CEN.												
Ohio	3	1	13	8	1	1	24	8	13	1	0	1
Indiana [2]	8	5	5	3	4	4	5	1	3	1	1	1
Illinois [2]	10	5	13	2	6	6	9	22	11	1	2	2
Michigan [3]	6	1	6	------	------	------	9	55	27	2	1	1
Wisconsin	0	1	1	6	20	12	43	79	33	0	0	1
W. NO. CEN.												
Minnesota	2	2	2	------	2	2	1	1	6	0	0	0
Iowa [3]	2	17	5	1	------	------	4	15	4	0	2	1
Missouri [3]	6	1	7	1	------	9	6	2	2	0	2	1
North Dakota	0	4	2	------	1	1	6	0	2	0	0	0
South Dakota	9	0	0	------	------	------	3	0	0	0	1	1
Nebraska	0	0	1	------	------	------	2	3	2	0	0	0
Kansas	3	2	2	------	6	------	17	12	2	0	0	0
SO. ATL.												
Delaware	0	0	0	------	------	------	0	2	------	0	0	0
Maryland [2] [3]	1	1	3	2	2	2	16	3	4	1	1	1
Dist. of Col.	0	2	2	------	------	------	6	3	3	0	0	1
Virginia [3]	5	15	22	8	38	------	4	10	10	5	1	1
West Virginia [2] [3]	0	2	8	6	7	9	31	1	2	0	0	1
North Carolina [3]	32	4	44	------	------	------	12	2	19	1	0	2
South Carolina [4]	10	4	4	43	90	90	10	10	6	2	1	0
Georgia [4]	18	7	14	19	25	------	28	4	------	0	0	0
Florida [4]	1	3	3	6	3	1	4	0	1	0	0	0
E. SO. CEN.												
Kentucky	7	9	11	1	2	2	8	23	15	1	0	1
Tennessee	9	4	6	2	4	7	2	7	6	1	1	0
Alabama [4]	18	9	13	6	3	5	16	27	3	1	3	2
Mississippi [3]	11	12	13	------	------	------	------	------	------	0	0	0
W. SO. CEN.												
Arkansas	7	6	14	2	3	4	14	4	3	0	0	0
Louisiana [4]	0	5	7	------	1	5	3	0	------	1	1	1
Oklahoma	7	5	6	6	5	8	2	1	3	0	0	0
Texas [3] [4]	18	22	28	285	108	67	35	29	18	1	3	2
MOUNTAIN												
Montana	2	5	1	------	------	------	3	9	9	0	0	0
Idaho	0	0	0	------	------	------	3	0	0	0	0	0
Wyoming [3]	0	0	0	4	------	------	0	0	0	0	0	0
Colorado	1	4	4	20	------	------	14	14	7	1	0	0
New Mexico	0	5	5	------	------	------	5	6	1	0	1	0
Arizona	1	0	0	30	80	13	10	7	4	0	0	0
Utah [3]	0	0	0	1	------	------	3	9	8	0	0	0
Nevada [3]	0	------	------	------	------	------	0	------	------	0	------	------
PACIFIC												
Washington	2	0	0	------	------	------	6	3	4	1	0	0
Oregon	1	1	1	4	5	4	16	9	5	1	0	0
California [4]	5	10	15	16	10	11	90	26	43	0	0	0
Total	229	185	362	486	383	339	689	666	633	27	24	26
35 weeks	8,075	9,231	14,417	600,897	169,989	152,280	832,204	230,037	270,969	1,467	1,211	2,214

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended August 30, 1941, and comparison with corresponding week of 1940 and 5-year median—Con.

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median 1936–40	Week ended		Median 1936–40	Week ended		Median 1936–40	Week ended		Median 1936–40
	Aug. 30, 1941	Aug. 31, 1940		Aug. 30, 1941	Aug. 31, 1940		Aug. 30, 1941	Aug. 31, 1940		Aug. 30, 1941	Aug. 31, 1940	
NEW ENG.												
Maine	4	1	1	1	0	2	0	0	0	1	3	3
New Hampshire	2	0	0	0	2	0	0	0	0	1	0	0
Vermont	3	0	0	4	0	1	0	0	0	6	0	0
Massachusetts	21	2	3	52	10	18	0	0	0	3	7	4
Rhode Island	5	1	0	3	2	2	0	0	0	0	0	0
Connecticut	5	0	1	5	7	4	0	0	0	5	7	4
MID. ATL.												
New York	69	20	20	62	38	46	0	0	0	26	12	28
New Jersey [2]	29	4	4	21	19	16	0	0	0	4	4	6
Pennsylvania	65	13	13	32	42	59	0	0	0	23	10	24
E. NO. CEN.												
Ohio	36	21	14	34	17	34	0	0	0	12	6	28
Indiana [2]	6	68	2	7	23	28	0	0	0	0	6	14
Illinois [2]	31	20	19	43	70	70	0	1	1	10	16	22
Michigan [3]	26	135	34	31	41	62	0	3	0	11	4	9
Wisconsin	3	19	7	24	30	42	0	0	0	4	1	1
W. NO. CEN.												
Minnesota	21	6	6	15	15	15	0	3	3	0	1	1
Iowa [2]	0	56	2	7	13	13	0	0	2	2	0	4
Missouri [2]	5	18	1	14	6	16	0	1	1	9	8	25
North Dakota	0	1	1	2	3	4	0	0	0	0	2	1
South Dakota	3	5	1	11	1	6	0	3	1	0	0	0
Nebraska	0	13	2	3	2	4	0	0	0	1	2	1
Kansas	3	43	3	29	19	23	0	0	0	4	7	7
SO. ATL.												
Delaware	0	0	0	3	0	0	0	0	0	0	1	1
Maryland [2] [3]	32	1	1	9	5	11	0	0	0	6	6	9
Dist. of Col.	8	0	1	6	4	2	0	0	0	1	4	4
Virginia [2]	5	7	3	7	1	6	0	0	0	6	5	13
West Virginia [2] [3]	4	41	2	21	11	12	0	0	0	7	6	12
North Carolina [3]	10	1	2	17	23	24	0	0	0	11	29	20
South Carolina [4]	8	1	1	3	8	3	0	0	0	9	8	10
Georgia [4]	[5] 50	3	2	5	3	10	0	0	0	32	23	18
Florida [4]	16	3	3	2	2	2	0	0	0	7	3	3
E. SO. CEN.												
Kentucky	15	10	7	17	17	29	0	0	0	20	16	33
Tennessee	29	4	3	8	10	10	0	0	0	20	15	13
Alabama [4]	65	4	4	11	20	17	0	0	0	6	14	14
Mississippi [3]	12	0	2	6	4	8	0	0	0	18	13	9
W. SO. CEN.												
Arkansas	3	1	1	8	4	4	0	0	0	9	33	19
Louisiana [4]	3	7	0	2	6	6	1	0	0	13	24	20
Oklahoma	2	3	2	3	8	8	0	1	0	14	15	16
Texas [3] [4]	5	8	8	16	16	24	0	0	0	31	40	51
MOUNTAIN												
Montana	3	16	2	6	13	9	0	0	0	2	2	2
Idaho	1	1	1	5	3	3	0	0	0	0	0	2
Wyoming [2]	0	4	0	0	1	3	0	3	0	1	1	1
Colorado	0	3	2	11	7	7	0	0	0	0	5	4
New Mexico	0	2	1	0	0	1	0	0	0	0	4	7
Arizona	2	1	1	0	1	1	0	0	0	1	0	3
Utah [3]	3	3	1	2	2	7	0	0	0	1	1	1
Nevada [2]	0	-----	-----	0	-----	-----	0	-----	-----	1	-----	-----
PACIFIC												
Washington	0	20	1	8	9	9	0	0	0	3	7	3
Oregon	5	3	2	14	4	6	1	2	1	0	1	2
California [4]	6	13	13	27	39	54	0	0	0	7	7	12
Total	624	606	479	617	581	843	2	17	21	348	379	556
35 weeks	[5] 4,025	3,301	3,009	93,070	120,056	138,694	1,195	1,988	8,080	5,152	5,784	8,226

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended August 30, 1941, and comparison with corresponding week of 1940—Con.

Division and State	Whooping cough — Week ended Aug. 30, 1941	Whooping cough — Week ended Aug. 31, 1940
NEW ENG.		
Maine	19	23
New Hampshire	8	0
Vermont	16	3
Massachusetts	110	72
Rhode Island	12	1
Connecticut	38	20
MID. ATL.		
New York	299	216
New Jersey [2]	88	74
Pennsylvania	192	309
E. NO. CEN.		
Ohio	257	144
Indiana [2]	17	19
Illinois [2]	201	91
Michigan [3]	305	200
Wisconsin	271	59
W. NO. CEN.		
Minnesota	35	8
Iowa [2]	40	23
Missouri [2]	0	8
North Dakota	13	7
South Dakota	2	6
Nebraska	3	3
Kansas	63	41
SO. ATL.		
Delaware	1	4
Maryland [2, 3]	56	76
Dist. of Col.	15	9
Virginia [2]	10	22
West Virginia [2, 3]	13	43
North Carolina [2]	122	93
South Carolina [4]	61	18
SO. ATL.—continued		
Georgia [4]	19	12
Florida [4]	23	0
E. SO. CEN.		
Kentucky	47	27
Tennessee	30	25
Alabama [4]	25	21
Mississippi [3]	-------	-------
W. SO. CEN.		
Arkansas	13	5
Louisiana [4]	1	6
Oklahoma	11	8
Texas [3, 4]	136	142
MOUNTAIN		
Montana	32	6
Idaho	27	0
Wyoming [2]	35	2
Colorado	93	9
New Mexico	8	7
Arizona	7	14
Utah [3]	49	36
Nevada [2]	0	-------
PACIFIC		
Washington	65	23
Oregon	19	14
California [4]	194	215
Total	3,101	2,167
35 weeks	152,851	112,304

[1] New York City only.
[2] Rocky Mountain spotted fever, week ended Aug. 30, 1941, 21 cases, as follows: New Jersey, 1; Indiana, 1; Illinois, 5; Iowa, 2; Missouri, 2; Maryland, 2; Virginia, 2; West Virginia, 1; North Carolina, 3; Wyoming, 1; Nevada, 1.
[3] Period ended earlier than Saturday.
[4] Typhus fever, week ended Aug. 30, 1941, 70 cases, as follows: Alabama, 8; California, 1; Florida, 3; Georgia, 28; Louisiana, 7; South Carolina, 1; Texas, 22. The 123 cases of endemic typhus fever reported in Lavaca County, Texas, for the week ended Aug. 16 (Public Health Reports, Aug. 22, 1941) occurred during the period July 6–Aug. 9. A field study has revealed an unusually large rat population in Lavaca and adjoining counties.
[5] Report on corrected diagnoses shows a total of 519 cases of poliomyelitis in Georgia up to Aug. 23 instead of 551, the total of the weekly reports.

CONSOLIDATED MONTHLY STATE REPORTS FOR APRIL, MAY, AND JUNE 1941

Division and State	Actinomycosis	Chickenpox	Diphtheria	Dysentery, amoebic	Dysentery, bacillary	Dysentery, undefined	Encephalitis, epidemic or lethargic	German measles	Hookworm disease	Influenza	Malaria	Measles	Meningitis, meningococcus	Mumps	Ophthalmia neonatorum	Pellagra	Pneumonia, all forms
NEW ENG.																	
Maine		731	6		1			418		13		1,309	2	690			117
New Hampshire		50	1							4	1	529	2	197			5
Vermont		310	10					1,420				805	0	451			11
Massachusetts		3,628	36	2	17		5	1,697			3	12,058	32	4,085	([1])	3	[2] 807
Rhode Island		621	13					124		4		109	1	87			83
Connecticut		2,098	17	2				1,090		17	5	4,910	7	2,341	2		525
MID. ATL.																	
New York		9,002	154	13	188		16	21,050			14	56,706	64		[5] 29		6,241
New Jersey		5,391	61	1	1		2	22,241		112	2	28,605	16	4,231	16		993
Pennsylvania		10,014	163		4		6	8,119			5	62,541	47	12,453	2	2	1,597
E. NO. CEN.																	
Ohio		4,493	109	3			5	1,661		140	5	51,030	19	1,747		2	1,038
Indiana		823	111				4	716		121	2	11,023	6	452			205
Illinois	2	4,730	221	17	18		[3] 3	2,978		161	17	24,640	25	4,809	12	4	2,539
Michigan	3	5,768	32	2	25		2	2,767		52	6	33,489	20				1,041
Wisconsin		4,549	18				1			572		21,914	6	5,385			[2] 184
W. NO. CEN.																	
Minnesota	6	1,441	55	15	2					28	1	280	4		2		319
Iowa		1,006	32	1	1		2	62		207	1	2,549	3	2,356			242
Missouri		698	38	2	3	1	1			30	11	5,905	6	342		1	451
North Dakota		390	16							42		390	1	138			210
South Dakota		116	17							2		133	3	74			58
Nebraska		257	16							2	1	235	0	191			8
Kansas		1,027	67		1		12	89		63	4	8,239	6	418		1	468
SO. ATL.																	
Delaware		104	1					19				1,700	0	45			13
Maryland		1,188	37	3	9	5		7,937		104	3	4,933	41	1,076	1	2	1,090
Dist. of Col		430	12							8		3,186	2	180		1	255
Virginia		771	90		529					2,126	25	18,516	42	859		22	916
West Virginia		337	66		2		1			128	2	7,325	13	602		2	84
North Carolina		1,168	111		4			8,306		107	19	18,162	16			14	92
South Carolina		688	210				([4])	3,164	294	3,103	2,267	8,125	9	707	5	449	1,421
Georgia		335	50	10	101	3	1		1,674	805	273	6,708	2	523		50	454
Florida		462	36	11	8		1	524	2,492	759	38	6,529	5	258		9	290

[1] 241 cases of ophthalmia neonatorum and suppurative conjunctivitis reported.
[2] Lobar pneumonia only.
[3] 16 cases of unspecified type also reported.
[4] 7 cases of unspecified type reported.
Exclusive of New York City.

CONSOLIDATED MONTHLY STATE REPORTS FOR APRIL, MAY, AND JUNE 1941—Continued

Division and State	Actinomycosis	Chickenpox	Diphtheria	Dysentery, amoebic	Dysentery, bacillary	Dysentery, undefined	Encephalitis, epidemic or lethargic	German measles	Hookworm disease	Influenza	Malaria	Measles	Meningitis, meningococcus	Mumps	Ophthalmia neonatorum	Pellagra	Pneumonia, all forms
E. SO. CEN.																	
Kentucky		592	50	2	49			1,208		137	10	12,598	16	2,411		4	207
Tennessee	1	460	49	1	28		3	1,360		528	103	6,091	18	1,230	5	42	1,212
Alabama		356	72	1			3	513		651	718	5,420	15	1,264		76	773
Mississippi		1,823	51	638	3,835				1,964	5,596	9,456	10,047	17	3,862	42	1,277	2,220
W. SO. CEN.																	
Arkansas		223	43	17	95			574	88	1,031	712	3,804	6	1,215		46	376
Louisiana		56	23	1	38				163	67	130	622	10	96		6	285
Oklahoma		248	55	2	36		3		8	535	439	1,609	4	543	2	15	494
Texas		2,518	266	100	774		18			6,714	1,893	12,699	28	3,025	33	491	2,209
MOUNTAIN																	
Montana		847	20	1	4		4	151		42		446	3	102			25
Idaho		79	2					39		9		259	0	160			9
Wyoming		188	15				1	70		2		923	0	105			6
Colorado		1,532	113				1			263		5,108	3	1,126			145
New Mexico		416	16	7	6	2	3	252		23	9	2,324	0	406		6	254
Arizona		368	33			494	1	148		1,009	1	1,303	1	426	1	9	485
Utah		1,351	14	1			3	1,711		151		466	1	301			118
Nevada		67					1			9		334	0	24			31
PACIFIC																	
Washington		2,061	15		3		[5] 5	4,102		69	1	609	5	2,978			75
Oregon		717	28	4						115	6	2,352	7	373			142
California		13,769	187	80	149		16	14,542		4,930	59	6,400	25	12,924	8		[2] 607
Total	12	90,297	2,856	937	5,931	505	[5] 124	109,140	6,683	30,591	16,242	476,131	559	77,268	161	2,534	31,430
Second quarter 1940	13	81,547	2,844	796	5,201	326	181	3,825	9,254	23,282	17,609	133,067	432	42,156	408	2,817	35,304
Alaska		71						971		142		199		24			31
Hawaii		392	26	8	27			278	28	31		861		85			[2] 39

[5] 1 case of equine type included.

[2] Lobar pneumonia only.

CONSOLIDATED MONTHLY STATE REPORTS FOR APRIL, MAY, AND JUNE 1941—Continued

CONSOLIDATED MONTHLY STATE REPORTS FOR APRIL, MAY, AND JUNE 1941—Continued

Division and State	Poliomyelitis	Puerperal septicemia	Rabies in animals	Rabies in man	Rocky Mountain spotted fever	Scarlet fever	Septic sore throat	Smallpox	Tetanus	Trachoma	Trichinosis	Tuberculosis, all forms	Tularemia	Typhoid and paratyphoid fever	Typhus fever	Undulant fever	Vincent's infection	Whooping cough
NEW ENG.																		
Maine	1				0	88	7	0				136		6		11	3	305
New Hampshire	1				0	29	3	0				53		4		11		114
Vermont	0				0	103		0				25		6		18	26	173
Massachusetts	2		6		0	2,343	58	0	9	4	11	1,003		52		32		2,943
Rhode Island	0		2		0	163	42	0				506		2		5	1	338
Connecticut	1				0	785	85	0	3		2	352		15	1	42		793
MID. ATL.																		
New York	11		45		4	5,780	224	0	13		68	4,218		97	8	82	[6] 136	3,719
New Jersey	6		76		2	2,799	49	0	3	2	6	975		25	2	11		1,372
Pennsylvania	10			2	2	4,285		0	1	1	1	623	3	87		19		4,434
E. NO. CEN.																		
Ohio	10	4		2	1	3,132	34	6	2	1	3	1,389	2	49		28		4,403
Indiana	1				1	1,136	5	11		4		426		19		4		423
Illinois	14		89		2	3,429	28	45	5	93	4	2,526	6	56		51	64	1,204
Michigan	4	1	26		0	3,042	297	58	2		3	1,402	1	26		39	41	4,396
Wisconsin	5				0	1,314	5	59				302	2	4	1	35		1,544
W. NO. CEN.																		
Minnesota	9		8		0	578	30	9	4	2		554	10	10		53		1,266
Iowa	2		18		5	412	44	53				[7] 113	3	15		65		548
Missouri	0		1		4	1,252	27	41	2	123		628	9	17		5		672
North Dakota	0				0	32	12	5		1		91	2	5		4	18	292
South Dakota	4				4	118	4	50		4		79		1		3		220
Nebraska	0				0	185	1	3				50		2		1		202
Kansas	1		4		0	367	30	4		2		279	8	17	3	18	34	1,850
SO. ATL.																		
Delaware	0		5		5	186		0				[7] 31		1		1		44
Maryland	3				14	460	102	0	2		1	904	1	21	1	7	66	1,175
Dist. of Col.	0				0	129		0				585		8				196
Virginia	6				8	289	1,167	0		2		[7] 845	3	38	1	4		1,261
West Virginia	3				1	429	44	4				551		51		1		733
North Carolina	6				1	230	33	3				1,294	3	35	8	2	8	3,732
South Carolina	7		97		0	63	18	3	18			277	1	48	6	5		2,007
Georgia	36				1	167	167	6			2	459	17	85	95	45		401
Florida	63				0	35		0			1	220	1	64	39	4	12	245

[6] Exclusive of New York City.

[7] Respiratory only.

CONSOLIDATED MONTHLY STATE REPORTS FOR APRIL, MAY, AND JUNE 1941—Continued

Division and State	Poliomyelitis	Puerperal septicemia	Rabies in animals	Rabies in man	Rocky Mountain spotted fever	Scarlet fever	Septic sore throat	Smallpox	Tetanus	Trachoma	Trichinosis	Tuberculosis, all forms	Tularemia	Typhoid and paratyphoid fever	Typhus fever	Undulant fever	Vincent's infection	Whooping cough
E. SO. CEN.																		
Kentucky	7				1	1,113	121	19		70		512	2	61		3		853
Tennessee	7	1		1	3	705	115	11	1	24		970	9	58	3	4	18	887
Alabama	18		52		1	164		1	6			923	9	15	45	9		760
Mississippi	16	74			1	36		15		18		433	15	35	10	8		3,418
W. SO. CEN.																		
Arkansas	3	2	62	1	0	63	437	16	4	577		330	38	50	1	5		503
Louisiana	9		17		0	58	62	3	6	1		[7] 367	6	96	15	14		134
Oklahoma	6				2	190	211	15	2	188		611	8	45		37	21	288
Texas	22		20		0	497		16		41		951	14	157	105	116		4,280
MOUNTAIN																		
Montana	3				82	240	14	1		3		147	17	6		5	1	230
Idaho	0				9	70	1	2		1		[7] 10		6		2	3	180
Wyoming	2				62	95	7	0				7	20	1				57
Colorado	2				18	296	18	2				[7] 167	2	13		11		2,367
New Mexico	3	3	28	1	0	54	9	0	1			255	2	19		3		327
Arizona	5				0	66	7	9		175		402		8	2	9		460
Utah	0				7	103	8	1		24		40	19	4		3		906
Nevada	0				3	6		1				26		3				73
PACIFIC																		
Washington	3		25		2	205	5	10		3	1	639	2	18		15	11	1,594
Oregon	3		11		5	103	19	36				134		21		2	21	296
California	53		100		0	1,465	16	6	18	36	16	2,460	6	59	7	85		9,066
Total	368	85	692	7	251	38,889	3,586	524	102	1,400	119	30,289	241	1,541	353	938	484	67,684
Second quarter 1940	416	90	866	11	192	51,037	2,952	846	102	864	147	28,024	226	1,677	261	968	470	49,265
Alaska	4						20					199		1		1	3	9
Hawaii						9			7	3	13	175		29	23			75

Anthrax: Vermont, 1; Massachusetts, 2; New York, 4; New Jersey, 4; Pennsylvania, 5; Delaware, 1; Arizona, 1.
Botulism: Illinois, 1; California, 3.
Colorado tick fever: Wyoming, 7; Colorado, 7.
Dengue: South Carolina, 6; Florida, 1; Mississippi, 10; Louisiana, 18; Texas, 26.
Diarrhea: Ohio, 31 (under 2 years; enteritis included); Michigan, 48 (infant diarrhea); Maryland, 15; South Carolina, 3,202; New Mexico, 10 (enteritis included).
Enteritis: Kansas, 1; Washington, 17 (8, under 2 years; 9, over 2 years).
Food poisoning: Illinois, 10; Kansas, 6; California, 207.
Granuloma, coccidioidal: California, 10.
Leprosy: Hawaii Territory, 8; Minnesota, 1; Louisiana, 3; Texas, 5; California, 2.
Plague: California, 1.
Psittacosis: New York, 2; Illinois, 1; District of Columbia, 1.
Rat bite fever: Illinois, 2.
Relapsing fever: Kansas, 1; Texas, 2; California, 1.
Weil's disease: Michigan, 10; Maryland, 4.

[7] Respiratory only.

WEEKLY REPORTS FROM CITIES

City reports for week ended August 16, 1941

This table lists the reports from 134 cities of more than 10,000 population distributed throughout the United States, and represents a cross section of the current urban incidence of the diseases included in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Maine:											
Portland	0	------	0	1	1	0	0	0	0	6	25
New Hampshire:											
Concord	0	------	0	0	0	0	0	1	0	0	6
Manchester	0	------	0	0	0	1	0	1	0	0	15
Nashua	0	------	0	0	0	0	0	0	0	0	5
Vermont:											
Burlington	0	------	0	1	0	0	0	0	0	0	8
Rutland	0	------	0	0	0	0	0	0	0	0	2
Massachusetts:											
Boston	0	------	0	7	5	11	0	5	2	35	154
Fall River	0	------	0	0	1	4	0	2	0	6	29
Springfield	0	------	0	5	0	1	0	0	0	8	37
Worcester	0	------	0	1	4	0	0	0	0	7	46
Rhode Island:											
Pawtucket	0	------	0	0	0	0	0	0	0	0	15
Providence	0	------	0	5	0	1	0	3	1	13	62
Connecticut:											
Bridgeport	0	------	0	7	1	0	0	1	0	1	28
Hartford	0	------	0	2	0	0	0	0	0	1	33
New Haven	0	------	0	2	0	1	0	1	0	1	45
New York:											
Buffalo	0	------	0	5	5	5	0	7	0	16	130
New York	11	3	0	30	43	14	0	73	3	126	1,188
Rochester	0	------	0	6	2	1	0	2	0	8	57
Syracuse	0	------	0	0	1	0	0	1	1	15	40
New Jersey:											
Camden	0	------	0	0	3	0	0	2	0	8	31
Newark	0	1	0	1	2	3	0	3	0	26	71
Trenton	0	------	0	0	1	1	0	1	0	2	49
Pennsylvania:											
Philadelphia	0	------	0	1	16	13	0	19	6	37	401
Pittsburgh	2	------	0	4	6	5	0	6	2	11	132
Reading	0	------	0	1	0	0	0	2	0	0	19
Scranton	0	------	-------	1	-------	0	0	-------	0	1	-------
Ohio:											
Cincinnati	0	------	0	0	2	5	0	8	0	9	136
Cleveland	0	------	0	2	1	3	0	14	1	58	169
Columbus	0	------	0	4	3	3	0	1	0	10	85
Toledo	0	------	0	9	2	2	0	2	0	33	63
Indiana:											
Anderson	0	------	0	0	0	0	0	0	0	0	11
Fort Wayne	0	------	0	0	0	0	0	0	1	0	27
Indianapolis	0	1	0	4	3	1	0	3	0	7	89
Muncie	0	------	0	0	0	1	0	0	0	2	6
South Bend	0	------	0	0	0	0	0	0	0	0	17
Terre Haute	0	------	0	0	0	0	0	0	0	0	8
Illinois:											
Alton	0	------	0	0	1	0	0	0	0	0	9
Chicago	2	------	0	4	9	14	0	34	0	128	553
Elgin	0	------	0	0	0	0	0	0	0	7	3
Moline	0	------	0	0	0	0	0	0	0	4	14
Springfield	0	------	0	4	3	2	0	0	0	0	16
Michigan:											
Detroit	1	1	0	12	1	23	0	9	1	94	197
Flint	0	------	0	1	1	1	0	0	0	1	27
Grand Rapids	0	------	0	0	0	0	0	0	2	7	30
Wisconsin:											
Kenosha	0	------	0	1	0	0	0	0	0	1	6
Madison	0	------	0	14	0	0	0	0	0	1	23
Milwaukee	0	------	0	14	3	10	0	3	0	120	80
Racine	0	------	0	1	0	0	0	0	0	1	19
Superior	0	------	0	0	0	2	0	0	0	7	10
Minnesota:											
Duluth	0	------	0	0	0	0	0	0	0	12	17
Minneapolis	0	------	0	1	1	2	0	2	0	21	95
St. Paul	1	------	0	1	3	1	0	0	0	11	42
Iowa:											
Cedar Rapids	0	------	-------	0	-------	0	0	-------	0	1	-------
Davenport	0	------	-------	0	-------	0	0	-------	0	0	-------
Des Moines	1	------	-------	4	-------	3	0	-------	1	4	34
Sioux City	1	------	-------	0	-------	0	0	-------	0	8	-------
Waterloo	0	------	-------	1	-------	0	0	-------	0	5	-------

City reports for week ended August 16, 1941—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Missouri:											
Kansas City	1	-	0	1	4	0	0	3	0	5	89
St. Joseph	0	-	0	1	3	0	0	0	0	0	22
St. Louis	2	-	1	3	7	4	0	4	0	24	149
North Dakota:											
Grand Forks	0	-	-	0	-	0	0	-	0	0	-
Minot	0	-	0	2	0	0	0	0	0	0	13
South Dakota:											
Aberdeen	0	-	-	0	-	0	0	-	0	1	-
Sioux Falls	0	-	-	0	-	0	0	-	0	0	9
Nebraska:											
Lincoln	0	-	-	0	-	1	0	-	0	6	-
Omaha	0	-	0	0	1	0	0	1	0	0	61
Kansas:											
Lawrence	0	-	0	0	0	0	0	0	0	6	1
Topeka	0	-	0	0	0	0	0	1	0	26	10
Wichita	0	-	0	3	1	2	0	0	0	1	24
Delaware:											
Wilmington	0	-	0	0	2	0	0	0	0	4	27
Maryland:											
Baltimore	0	1	1	33	8	3	0	7	1	52	182
Cumberland	0	-	0	0	1	0	0	0	0	0	9
Frederick	0	-	0	1	0	0	0	0	0	0	1
Dist. of Col.:											
Washington	1	2	1	6	4	7	0	11	0	1	155
Virginia:											
Lynchburg	0	-	0	12	0	0	0	0	0	3	5
Norfolk	0	-	0	0	2	1	0	3	0	2	36
Richmond	0	-	0	1	2	1	0	0	0	0	35
Roanoke	0	-	0	0	0	0	0	1	0	0	14
West Virginia:											
Charleston	0	-	0	1	2	0	0	0	1	0	18
Huntington	2	-	-	0	-	0	0	-	0	0	-
Wheeling	0	-	0	1	0	0	0	1	0	0	20
North Carolina:											
Gastonia	0	-	-	0	-	1	0	-	0	1	-
Raleigh	0	-	0	0	0	0	0	0	0	3	3
Wilmington	0	-	0	0	0	0	0	0	1	21	10
Winston-Salem	0	-	0	0	0	0	0	0	0	1	16
South Carolina:											
Charleston	0	1	0	0	1	0	0	0	0	0	16
Florence	0	-	-	0	-	1	0	-	0	0	-
Greenville	0	-	0	0	0	0	0	0	0	1	15
Georgia:											
Atlanta	0	2	0	0	2	1	0	4	0	1	81
Brunswick	0	-	0	0	0	0	0	0	0	0	6
Savannah	0	-	1	2	1	0	0	2	0	1	28
Florida:											
Miami	0	-	0	0	3	0	0	2	0	1	27
St. Petersburg	0	-	0	0	1	0	0	0	0	0	25
Tampa	0	-	0	0	0	0	0	0	0	0	27
Kentucky:											
Ashland	0	-	0	2	0	0	0	1	0	0	10
Covington	0	1	0	0	1	0	0	0	0	0	14
Lexington	0	-	0	0	0	0	0	1	0	6	12
Louisville	0	1	0	0	6	1	0	3	1	21	71
Tennessee:											
Knoxville	0	-	0	1	0	0	0	1	2	1	29
Memphis	0	-	1	1	0	0	0	5	2	9	60
Nashville	0	-	0	2	1	0	0	2	0	4	42
Alabama:											
Birmingham	0	-	0	1	3	1	0	6	0	1	85
Mobile	1	1	1	1	2	0	0	1	0	0	18
Montgomery	0	-	-	0	-	0	0	-	0	0	-
Arkansas:											
Little Rock	0	-	0	1	3	0	0	1	0	0	34
Louisiana:											
Lake Charles	0	-	0	0	1	0	0	0	0	0	4
New Orleans	1	-	0	1	8	1	0	8	1	9	172
Shreveport	0	-	0	0	4	1	0	3	1	0	30
Oklahoma:											
Oklahoma City	0	1	0	0	3	0	0	0	0	0	38
Tulsa	0	-	0	0	1	0	0	0	0	7	16
Texas:											
Dallas	0	-	0	9	0	1	0	3	1	5	55
Fort Worth	0	-	0	0	2	0	0	3	0	0	37
Galveston	0	-	0	0	1	0	0	0	0	1	11
Houston	2	-	0	1	8	3	0	6	0	0	80
San Antonio	1	5	0	0	1	0	0	8	1	1	63

City reports for week ended August 16, 1941—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Montana:											
Billings	0		0	0	0	0	0	0	0	1	9
Great Falls	0		0	0	0	0	0	0	0	13	10
Helena	0		0	0	0	0	0	0	0	5	2
Missoula	0		0	0	0	0	0	0	0	0	4
Idaho:											
Boise	0		0	0	0	0	0	1	0	1	8
Colorado:											
Colorado Springs	0		0	0	2	0	0	0	0	3	13
Denver	4	5	0	0	3	0	0	4	0	74	84
Pueblo	0		0	0	0	1	0	0	1	7	7
New Mexico:											
Albuquerque	0		0	0	2	0	0	1	0	2	12
Arizona:											
Phoenix	0	4		3		0	0		1	10	
Utah:											
Salt Lake City	0		0	2	2	0	0	0	1	17	25
Washington:											
Seattle	1		0	0	5	0	0	4	0	37	91
Spokane	0		0	0	0	3	0	0	0	4	33
Tacoma	0		0	0	0	1	0	0	0	2	21
Oregon:											
Portland	0		0	0	1	0	0	0	0	4	72
Salem	0			0		0	0		0	0	
California:											
Los Angeles	3	5	1	13	4	7	0	10	1	51	296
Sacramento	0		0	0	1	1	0	3	2	6	35
San Francisco	0		0	4	4	0	0	11	0	22	165

State and city	Meningitis, meningococcus		Poliomyelitis cases	State and city	Meningitis, meningococcus		Poliomyelitis cases
	Cases	Deaths			Cases	Deaths	
Massachusetts:				Delaware:			
Worcester	0	0	1	Wilmington	0	0	1
Rhode Island:				Maryland:			
Pawtucket	1	1	0	Baltimore	2	2	10
Providence	0	0	2	District of Columbia:			
Connecticut:				Washington	0	0	8
Bridgeport	0	0	3	Virginia:			
Hartford	0	0	3	Lynchburg	0	0	1
New York:				Georgia:			
Buffalo	0	1	1	Atlanta	0	0	9
New York	2	0	16	Savannah	0	0	3
Rochester	0	0	2	Florida:			
Pennsylvania:				St. Petersburg	0	0	1
Philadelphia	1	1	7	Tampa	0	0	1
Pittsburgh	0	0	2	Kentucky:			
Ohio:				Louisville	0	0	3
Cincinnati	0	0	1	Tennessee:			
Cleveland	0	0	30	Knoxville	0	0	5
Toledo	0	0	1	Albama:			
Indiana:				Birmingham	0	0	9
Fort Wayne	0	0	1	Mobile	0	0	1
Illinois:				Montgomery	0	0	2
Chicago	0	0	7	Louisiana:			
Springfield	0	0	2	New Orleans	0	0	2
Michigan:				Oklahoma:			
Detroit	0	0	6	Tulsa	0	0	2
Wisconsin:				Texas:			
Madison	0	0	1	Houston	0	0	1
Milwaukee	0	0	1	Montana:			
Superior	0	0	2	Billings	0	0	1
Minnesota:				Utah:			
Minneapolis	0	0	2	Salt Lake City	0	0	1
St. Paul	0	0	6	Washington:			
Missouri:				Seattle	0	0	2
St. Joseph	0	1	0	California::			
St. Louis	0	0	1	Los Angeles	0	0	2

Encephalitis, epidemic or lethargic.—Cases: Fall River, 2; New York, 6; Toledo, 1; Chicago, 1; Duluth, 2; Minneapolis, 5; St. Paul, 4; Sioux City, 4; Fargo, 17; Grand Forks, 22; Minot, 28; Aberdeen, 2; Omaha, 5; Wichita, 1. Deaths: Fall River, 1; New York, 2, Toledo, 1; Duluth, 1; Minneapolis, 1; St. Paul, 1; Fargo, 1; Omaha, 2; Lawrence, 1; Baltimore, 1; St. Petersburg, 1.

Pellagra.—Cases: Atlanta, 1; Savannah, 2.

Typhus fever.—Cases: Charleston, S. C., 1; Brunswick, 1; Savannah, 5; Miami, 1; Tampa, 1; New Orleans, 3; Fort Worth, 2; Houston, 3; San Antonio, 1. Deaths: Savannah, 1.

Rates (annual basis) per 100,000 population for a group of 88 selected cities (population, 1940, 33,885,623)

Period	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet-fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases
		Cases	Deaths							
Week ended Aug. 16, 1941	5.2	4.3	1.1	34.9	31.5	25.4	0.0	48.3	5.2	188.8
Average, 1936-40	10.3	3.9	1.6	40.3	40.0	33.5	0.3	51.4	10.7	196.8

PLAGUE INFECTION IN GROUND SQUIRREL AND FLEAS IN SISKIYOU COUNTY, CALIF.

Under date of August 19, 1941, Dr. Bertram P. Brown, Director of Public Health of California, reported that plague infection had been proved, by animal inoculation and cultures, in organs from 1 ground squirrel, *C. douglasii*, submitted to the laboratory on August 1 from a ranch 8 miles east and 3 miles south of Montague, Siskiyou County, Calif., and also that plague infection was found in a pool of 183 fleas taken from 18 ground squirrels of the same species on June 30 at the same location.

FOREIGN REPORTS

CANADA

Provinces—Communicable diseases—Week ended July 26, 1941.—During the week ended July 26, 1941, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis		3	1		7		1	1	2	15
Chickenpox		6		30	61	9	34	40	18	198
Diphtheria	4	15	1	20	1	1		2		44
Dysentery				6						6
Influenza									2	2
Measles		3		105	103	10	13	14	68	316
Mumps				52	43	6	7	8	7	123
Pneumonia		2			2				2	6
Poliomyelitis			7		1	83	1		3	95
Scarlet fever		8	2	33	112	7	3	6	4	175
Trachoma							2			2
Tuberculosis	2	4	11	85	65	4				171
Typhoid and paratyphoid fever				17	6		1	2	1	27
Whooping cough		2		101	120	4		1	21	249

Manitoba—Poliomyelitis.—During the week ended August 29, 1941, 83 cases of poliomyelitis were reported in the Province of Manitoba (162 for the preceding week), bringing the total to 680, of which 221 have been reported in Winnipeg and adjacent suburban areas. The disease is stated to be of mild type, the mortality rate now being about 1.5 percent. Twenty-six percent of the cases have occurred in children between the ages of 10 and 14 (the 5-year age group showing the highest incidence), and 91 percent have been in persons under 25 years of age. The ratio of male to female patients has been about 2½ to 1 (71 percent males, 29 percent females).

Manitoba—Encephalitis.—During the week ended August 29, 1941, 190 cases of encephalitis (epidemic or lethargic) were reported in the Province of Manitoba as compared with 127 for the preceding week. This brings the total to 339 cases during the past three weeks. The disease is stated to be of comparatively mild type, with a mortality rate of about 8 percent. The incidence has been highest in the older age group, only 9 percent of the cases having occurred in children under 5 years of age, while 21 percent occurred in persons 60–69 years of age (the 5-year age group of highest incidence). The ratio of male to female patients has been 1½ to 1 (60 percent males, 40 percent females).

COSTA RICA

Communicable diseases—July 1941.—During the month of July 1941, certain communicable diseases were reported in Costa Rica as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Chickenpox	5		Poliomyelitis	3	
Diphtheria	36	4	Scarlet fever	58	
Measles	7		Typhoid and paratyphoid fever	15	2
Mumps	2				

JAMAICA

Notifiable diseases—4 weeks ended August 2, 1941.—During the 4 weeks ended August 2, 1941, cases of certain notifiable diseases were reported in Kingston, Jamaica, and in the island outside of Kingston, as follows:

Disease	Kingston	Other localities	Disease	Kingston	Other localities
Chickenpox	2	17	Scarlet fever	1	3
Diphtheria		2	Tuberculosis	22	72
Dysentery	3		Typhoid fever	7	28
Leprosy	1	3			

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—Only those places are included which had not previously reported any of the above-named diseases, except yellow fever, during the current year. All reports of yellow fever are published currently.

A cumulative table showing the reported prevalence of these diseases for the year to date is published in the PUBLIC HEALTH REPORTS for the last Friday of each month.

Yellow Fever

Venezuela—Bolivar State—Guasipati.—Yellow fever was reported present on July 6, 1941, in Guasipati, Bolivar State, Venezuela.

×